BELL TELEPHONE QUARTERLY

VOL. XVII APRIL, 1938 NO. 2

"FLYING LABORATORIES"

"OVERSEAS OPERATOR"

DEALER IDENTIFICATION THROUGH CLASSIFIED TELEPHONE DIRECTORIES

TRAINING OF PLANT DEPARTMENT PERSONNEL

THE ART OF THE MAKER

AMERICAN TELEPHONE & TELEGRAPH CO. • NEW YORK

BELL TELEPHONE QUARTERLY

A Medium of Suggestion and a Record of Progress

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COMMUNICATION HISTORY IN THE MAKING: TELEPHONE ENGINEERS IN A TWO-WAY RADIO TELEPHONE CONVERSATION WITH AN AIRPLANE IN 1917. SEE "FLYING LABORATORIES," WHICH BEGINS ON THE OPPOSITE PAGE.

"Flying Laboratories"

(Editor's Note: It will interest readers of the BELL TELEPHONE QUARTERLY *to know that Captain A. R. Brooks, whose article appears below, has served for ten years as chief pilot and Supervisor of the Air Operations Group of the Bell Telephone Laboratories. From 1917 to 1922 he was in the U. S. Army Air Service, and the single-seater pursuit plane which he used in France is now in the Smithsonian Institution in Washington, D. C.)*

THE Bell System's contributions to the development of the art of radio telephony are principally suggested to the public mind in the present scope of the System's overseas service which, inaugurated in 1927, now connects American telephones with those in some 70 foreign countries.

That these contributions have also been of vital importance to the development of the aviation industry is not so generally appreciated. The object of this article is to describe briefly some of the System's research and development activities that are to-day reflected in the radio telephone instrumentalities so widely used to afford two-way communication between airplane pilots and ground terminals.

Aviation men, of course, are familiar with the facilities established in 1928 by the Bell Telephone Laboratories at Hadley Airport, New Brunswick, New Jersey, for the purpose of making field tests of apparatus and equipment designed by the System's radio experts. These facilities comprise shops, an office, hangar space, and first one and then two airplanes. Known in aviation circles as the Bell System's "Flying Laboratories," the two airplanes have already made nearly 2500 separate flights, totaling more than 270,000 miles of air travel.

But the story of this laboratory investigation really begins more than a decade before the advent of these "Flying Laboratories." It was in 1916, following the System's early demonstrations of transatlantic radio telephony, that the United

States Government first called upon the Bell System for co-operation in investigating problems relating to aircraft communication. The first request resulted in experimental radio telephone equipment for the Navy Department. The Chief Signal Officer of the Army asked Laboratories' officials in May, 1917, to undertake the emergency development of equipment for military aircraft. The demonstration a few weeks later of radio telephone communication between an airplane in flight and a ground station using apparatus both designed and built by the Laboratories' engineers is one of the most interesting and historic episodes in the story of the Bell System's wartime activities.

During the post-war period, aviation in America made rapid progress. By 1920, the Post Office Department was experimenting with a transcontinental mail service involving the use of planes and railroad trains in coöperation. By 1923, many routes were beacon lighted, enabling extended airplane performance through the inclusion of night flying. Two years later, the first privately organized corporations undertook contracts to fly United States mail routes. The Air Commerce Act, passed in 1926, intensified the growing interest in air transportation and the epochal flight of Charles Lindbergh in 1927 focussed public attention on the potentialities of air travel. Public interest was high. But to those who were studying all aspects of the situation, it was apparent that if the airplane was to become an efficient common carrier, its pilot must have trustworthy radio facilities for air navigation and for two-way radio telephone communication with ground sources of information essential for successful flying.

With the development of air transport obviously hampered by the unsatisfactory state of the radio telephone art, it was decided that the Bell Laboratories should enlarge the scope of their participation in the general attack on the specific problems involved. The Bureau of Air Commerce was already sponsoring hourly broadcasts of weather information, which meant that

airplane radio telephone receivers were an immediate requirement. Promoters of transcontinental air transport were discussing the need for two-way communication sets. It was because of such circumstances that the Laboratories in 1927 undertook a fundamental investigation of radio frequency bands suitable for aircraft use and the development of improved apparatus and circuits suitable for two-way telephone communication systems between aircraft and ground.

Although airplanes could have been borrowed for field experiments, it was considered impractical to use any that were not owned and therefore under complete control. One reason for this decision was that for every hour to be spent aloft, many days before and after flights might often be required for installations, removals, or ground tests of equipment. Furthermore, the items of equipment complementary to radio requirements of the infant industry were not yet accurately specified. Instrumentalities to eliminate noise and other troubles in aviation radio telephone sets, as well as power units, regulators, and similar accessories, needed coördinated study. The rapid change taking place from water-cooled to air-cooled engines also created new questions. Before the year was ended, therefore, a single-engined four-passenger Fairchild cabin monoplane was being assembled at Farmingdale, N. Y., to furnish the Laboratories a medium for uninterrupted research in this field.

In the next eighteen months this ship made possible many contributions to airplane communication through initial studies made under field-test flying conditions. Then an all-metal, trimotored Ford of 14-passenger capacity (13,500 pounds gross weight) was acquired in October of 1929, and during the following year the original Fairchild was exchanged for a new one of six-passenger capacity. Both the Ford and the second Fairchild are still in service.

A licensed transport pilot has supervised the air operations of the Bell Laboratories at Hadley Field. The station personnel has included a second experienced pilot as well as a licensed

mechanic and an expert technician. Added personnel has naturally been available from the Laboratories' staff in New York whenever peaks occurred in the development program. At any given time there have usually been from one to six engineers or assistants using the facilities of this particular field laboratory in arranging for or carrying out the ground or air tests.

Safety Precautions

From the very inception of the activity, the prime consideration was the factor of safety. Bell System employees were present during construction of each airplane by responsible manufacturers. All metal parts of each plane were carefully "bonded" to make one electrical unit. Additional structural members were added wherever there were requirements for special installations, such as provision for extra antenna supports, for cabin work-bench interchangeable with customary passenger seats, or for pedestals to mount the heavier laboratory measuring instruments. All wiring circuits were fused and, for those carrying high voltage, automatic cover switches were included, as in general laboratory practice.

The log books show that operation of the planes has largely been confined to the area over northern New Jersey. There were, however, special day or night flights to Washington, D. C., Pittsburgh and Bellefonte, Pa., Cleveland, Ohio, Albany, N. Y., Hartford, Conn., and to points over Long Island, N. Y.; and the record also shows flights to a few more distant cities such as Richmond, Va., Knoxville, Tenn., Dayton, Ohio, Chicago, Ill., Detroit, Mich., and Boston, Mass. There were also many flights to unnamed locations—regions in the sky nearly 20,000 feet high. These were in connection with tests for observation and correction of possible flash-over or sluggish relay action which might occur in some varieties of equipment operating under reduced pressures and lower temperatures. In

such upper altitudes, oxygen was made available for the occupants of the plane if the flight were a prolonged one.

All flights except the very first few have been made with scheduled two-way radio telephone contacts maintained with a Laboratories' ground station, as well as with commercial airports or government radio stations.

RANGE OF INVESTIGATIONS

The first flying tests involved studies of transmission to aircraft and were carried out simultaneously by a group of Laboratories' engineers in planes flying mountainous routes in western territory, and another group in the Laboratories' plane in the level eastern country. For this purpose a large field strength measuring-set, originally designed for use in automobiles, was cushioned in the cabin and carried through a wide range of altitudes and distances while recording signal strengths from ground radio stations which used different antenna systems or degrees of power. With data thus obtained, requirements of sensitivity and range for the first in a series of beacon and weather radio receivers were available. Aircraft radio transmitters were similarly developed and then, in sequence, several systems for two-way radio telephone communication between airplanes and ground stations.

A pilot's typical report during the early investigations was as follows: "In afternoon 8A Radio Transmitter was readjusted to 5690 kcs. from 4108 kcs. and tested with Whippany in preparation for next trip. Took off at 9:00 P.M. Lightning caused bad static both at Whippany ground station W3XN and in Fairchild W2XBX. Flew direct to Washington, D. C., at 2500 feet altitude, giving standard word lists for two-way conversation tests throughout. Station W3XN received clear signals from plane to position: beacon light No. 55 below Alexandria, Va. Noise level in plane receiver too high to understand station W3XN farther than light No. 60 (146 miles effective). Station W3XT received signals inter-

mittently and transmitted when plane approached Washington. Bad fading on this frequency. Indication: not practical for night use. Returned at 5000 feet to Wilmington, Del., where clouds forced drop to 4000. Landed 2:00 A.M. 3452 kcs. next trip."

Since accessories vital to the evolution of satisfactory radio systems on aircraft were unavailable, the "Flying Laboratories" became testing media for certain items of equipment other than radio. For example, dependable "shielded" spark plugs and ignition "harnesses," not completely reliable in 1928, were, within two years thereafter, commonplace and satisfactory in service; at one time, after a great deal of early trouble had been experienced, there were four different types of "shielded" plugs firing in the Ford engines for comparative study.

Likewise, in power units for the requirements of radio, the wind-driven generators hanging out on the struts of the Laboratories' planes soon gave way to engine-driven generators which, in their turn, were replaced by increasingly dependable dynamotor units.

Hundreds of flights were made for accumulation of data regarding limits and qualities, varying according to times of day, season, distance or altitude, of transmissions to or from the planes. First studied was obviously the beacon broadcast band (220–390 kcs.), used at once in practical ground-to-plane one-way application. Next came attention to the medium frequency band (2600–6500 kcs.) allocated for two-way communication, and then portions of the ultra-high radio frequency spectrum for pure research in the earlier period and latterly for diverse aircraft purposes as assigned by the Federal Communications Commission.

In every investigation, models of newly designed electrical and mechanical equipment were assembled, installed, tested, changed, rechecked, and then given reasonable airplane life-test by the pilot alone or with the coöperation of an observer.

LITERALLY A LABORATORY IN THE AIR: THE INTERIOR OF THE FORD PLANE DURING EARLY TESTS (IN 1929), SHOWING THE LABORATORIES' FIRST MODERN RECEIVER AND TRANSMITTER IN OPERATION IN THE FOREGROUND, WHILE MEASUREMENTS OF FIELD STRENGTH OF THE ASSOCIATED GROUND STATION ARE IN PROGRESS BEYOND. THE PILOT AND CO-PILOT ARE JUST VISIBLE AT THE CONTROLS.

THE BELL LABORATORIES' TRI-MOTORED "FLYING LABORATORY" MAKING AVIATION RADIO TELEPHONE STUDIES OVER NEW YORK CITY.

THE LABORATORIES' "FLEET": THE FORD (LEFT) AND THE (SECOND) FAIRCHILD PLANES. THE LABORATORIES' PLANES HAVE BEEN FAMILIAR TO HADLEY FIELD ATTENDANTS SINCE 1928.

Scores of voice transmitters, with changes both large and small, were thoroughly tested in the planes to assure final perfection of the comparatively few types best suited to pass high quality voice frequencies while excluding all other sound classified as noise. New antennas were mounted on the planes and given adequate study. New filters, chokes, or relays were inserted in various system circuits; new materials were tested for improved insulation qualities or for better shock-proof mounting; improved power units were evolved.

The field of investigation also included such matters as radio aids for instrument or "blind" flying. This received first attention in the test and furnishing of special two-way radio equipment for investigations sponsored by the Guggenheim Fund. Later the Laboratories' Fairchild was equipped with tandem control, the rear pilot being enclosed in a cabin section which could be entirely darkened. Approaches and simulated "blind" landings, testing radio aids in the form of suitable indicating instruments (in coöperation with the Bureau of Air Commerce), were made at Newark, N. J., where a "bent beam" was available to mark the path for a plane to glide to earth much as if coasting down an invisible toboggan slide.

Other radio receivers were assembled from quite different specifications, such as one to enable a fog-bound pilot to identify his position positively over a known but unseen point on the earth. Known as the "cone-marker," this type advises the pilot (who has brought his plane "blind" to the vicinity of the airport by utilizing the now well established radio range stations) the moment he enters the area influenced by localized special high frequency transmission from the point on the ground; once definitely fixed as to location, the pilot proceeds with his "blind" or instrument approach which lands him safely at the airport.

Tests of facsimile and teletypewriter transmission and reception apparatus have likewise been made in the Laboratories'

planes. And various developments such as anti-static direction finding and homing loops have received consideration.

With passage of several years, then, a later report of the pilot reads like this (with certain data deleted): "Coaxial antenna mounted in Ford and transmission line completed to radio receiver on cabin bench. Quarter-wave, shunt-connected rod antenna flown at 2500 feet out from ground station W2XID and at —— mile point courses checked to —— degrees. Two-way, during two flights, 4797.5 kcs. with W2XMZ and —— mcs. with W2XID." Another example: "With Ford motors running on ground at various speeds, voltage measurements taken with cathode-ray oscillograph on primary ignition circuits for interference-filter design data. UHF transmission from Fairchild to Deal; route —— degrees from Deal —— Miles. Altitude 3500 feet both directions. Two-way, station W2XMZ (Hadley) 4797.5 kcs. and 3415 kcs.; and WREE (Newark) 3105 kcs."

Practical Application

The aviation industry found the need of the newly designed apparatus so great that there was an immediate demand for the perfected two-way radio telephone system. In fact, the type of radio telephone equipment designed by the Bell Laboratories and manufactured by the Western Electric Company has been used since 1929 on scheduled air lines in the United States and elsewhere both for navigation and for dispatching.

In the ordinary course of procedure for test flights from Hadley Field, informal conferences are usually held, at which project engineers and the air operations supervisor discuss plans pertaining to the immediate objective of the flight, the equipment to be used, the scope of the ground or flying test, the routes to be flown, the altitudes to be maintained, and the data to be obtained.

As an example: there is to be a flight to test a modified direction-finder anti-static loop antenna on the Ford. When all

is in readiness and while motors are warming up, the pilot calls a Laboratories' ground station at Hadley Field, Whippany, or elsewhere. After leaving the airport he again checks with the ground station. Since there is now government control of air traffic, it is necessary for him to give a flight plan to the ground station at Newark in order to obtain approval for this particular flight as to time, direction, and altitude, as well as to learn of other possible traffic along the proposed route. While the approval may have been obtained previously over the land telephone, if more convenient, it is usually done at the beginning of every flight as another part of the test of the apparatus involved.

In calling a station on the planes' licensed channels, the pilot is "on the air" when he turns on the filament switch and presses the microphone button to talk, releasing the button when he wants to listen. Since all Bell System radio transmitters and some of the radio receivers are held on their assigned frequencies by quartz crystal controls, there is no adjusting whatsoever. To shift from one of these frequencies, the pilot merely rotates a small crank which in a few seconds, through remote control, selects any one of the three frequencies in the present air transport equipment.

The radio receivers ordinarily aboard the "Flying Laboratories" are two in number: one mechanically and electrically locked to the transmitter for two-way conversation and hence automatically tuned to a new channel with the transmitter; the other a variably tuned receiver using the band for government beacon or weather broadcast. The latter receiver is manually operated (by a separate control, dubbed "the coffee grinder," or by selective "push-button" if desired) and tunes to any of the radio range beacon stations giving continual guidance over the present 22,400 miles of Federal airways.

In the typical flight we are considering, the pilot flies to a predetermined location in space. By a remote control and indicator wired temporarily into his cockpit he may take sev-

eral bearings on land radio stations in order to check the accuracy of direction indicated with known direction. Or, he may check such details as the sharpness of beam in degrees of width while using the aural feature; or the degree of steadiness in received signal strength. During flight, engineers may make adjustments to parts of the equipment mounted on a cabin bench and connected to the rotatable loops hanging outside under the cockpit. Throughout the flight, the pilot reports to his ground station, and upon his return to Hadley Feld, the ship is turned over to the mechanic for usual maintenance, while pilot and observers assemble results and impressions of the test and decide on future operations.

So it is that years of research and experimentation with the "Flying Laboratories" and associated ground stations have brought about equipment that is of the utmost importance to commercial aviation. It is equipment that is extremely rugged, yet light in weight and of minimum size. To insure dependability, every possible detail had to be considered, from provision against failure due to continuous vibration, to insulation that withstands high voltages and moisture. The radio telephone apparatus that has resulted from the last decade of investigation, prefaced by the accomplishments of the war period, reflects the scientific attainments of the Laboratories' engineers and the high standards of the manufacturer, the Western Electric Company.

A. R. Brooks

"Overseas Operator"

MR. SMITH was lonely. While he has remained in Omaha, Mrs. Smith has been traveling in Europe. Her latest letter bore a date of two weeks earlier and was something less than satisfactory. Various questions are in Mr. Smith's mind: has she recovered from the cold she had mentioned; has she changed her mind about visiting Devonshire; when is she returning; shall he meet her in New York or Chicago? Mr. Smith has a happy thought: the telephone. Call her up! That's the way to get a quick answer! Hastily scanning her letter to see where she might be at this moment, Mr. Smith moves the dial: 2–1–1.

"Hello, Long Distance. I want a call to Brussels . . . Yes, Brussels, Belgium . . . Mrs. Smith . . . Wait, I'll give you the address. It's the Hotel Brabant . . . B-R-A-B-A-N-T . . . That's right. The address is 19 roo dee—I guess I'd better spell that too. R-U-E D-E R-O-G-I-E-R . . . What time is it in Brussels now? . . . All right, let me know if it's too late at night. I don't want to wake her up . . . If it's too late, I'll talk in the morning . . . about 8 o'clock . . . 8 o'clock *here* in Omaha." Giving his name and number, Mr. Smith hangs up his telephone.

But, fortunately, the six-hour difference between Omaha and Brussels hasn't made it too late, and before Mr. Smith has much more than re-read his wife's letter and speculated on what she may think when told he is calling, the telephone bell rings. "On your call to Brussels. We are ready." Then, "Hello, darling! How are you? . . . Yes, I hear you as clearly as though you were in the next room." And so, from the same telephone that he uses to call across the street or across the state, Mr. Smith chats with his wife across 1,500 miles of land

and 3,000 miles of ocean. Overseas service has added to the importance of his telephone.

In the United States, there are approximately 19,000 telephone central offices, to which are connected more than 19,000,000 telephones. At any one of these telephones there may be a Mr. Smith who wishes to call some one at any one of the 14,000,000 telephones located in seventy-odd overseas countries or territories. The manner in which this need is met and the various conditions which arise in the sequence of operating steps may best be described by considering the general process and incidents in handling overseas calls. The service, and the provisions and arrangements for handling the traffic, really start at the moment that the caller translates his wish into concrete form by lifting the receiver of his telephone to dial or call "Long Distance."

A Call Starts on Its Way

To the Long Distance operator our caller usually names the place he is calling. In the early days of the transatlantic service, many a Long Distance operator thrilled to hear a subscriber say he wanted Paris or Berlin, only to find that it was the namesake in Kentucky or New Jersey that was wanted. At the Long Distance offices in the cities where overseas radio circuits terminate—New York, Miami, and San Francisco—the answering operator, upon learning that an overseas point is wanted, usually transfers the caller directly to the overseas group, where the particulars of his call are taken by one of these specialized operators. In the case of other cities, the details are recorded by the answering Long Distance operator. Because in such a case the call must be passed to the overseas operator and as a rule more than the usual wait for a toll call would be involved, the caller does not wait at the telephone for completion of his call. Routing information is available at all offices showing that a call to Italy, for example, should be passed to the overseas operator at New York, one to Panama

to the corresponding operator at Miami, and a call to Japan via San Francisco. So directed, the Long Distance operator reaches the appropriate overseas operator and relays the particulars of the call. An overseas operator thus receives calls either directly from callers in her own city or from Long Distance operators in other cities.

The work at a group of overseas positions is generally divided functionally. Certain operators are assigned to work with the distant terminals and are spoken of as "circuit" operators. Others, who attend to the preliminary and preparatory work over the wire system, are called "report" operators. Individual operators during the course of the day may be assigned to work either as report operators or as circuit operators.

Accordingly, it is a report operator who receives the call. She records the particulars on a special ticket form which is generous in the space provided for the more extensive directions than are generally required on land line calls, as well as providing for many special notations for aid in completing and billing overseas calls. If we were to look over the shoulder of a New York overseas operator recording calls to Europe, we would note certain characteristics of the traffic. In the first place, while a call may be to any of twenty-six countries in Europe, the odds favor its being to Great Britain or France. It will be for a particular person, since in this service a call for a connection simply with anyone who may happen to answer the telephone in a foreign country is so rare as to be negligible. In sixty-five per cent of the cases, the call will be for an American, traveling or residing abroad. On six out of ten calls, the telephone number of the person desired will have been furnished by the caller—the percentage running slightly higher if the call is to London or Paris. On the remainder there will be a street address, or the name of a firm, corporation, institution or establishment. Twenty calls out of a hundred will be for persons staying at hotels, generally those patronized by visitors from these shores. Seventy-five per cent of the calls will be wanted

as soon as it is possible to complete them, but the remaining twenty-five per cent have been filed for completion at a later time or even a later day. The large proportion of calls filed in advance of the time wanted is without doubt due in part to differences in time of day between the calling and called places which put the daily routine of the calling and called persons out of phase; there is also an advantage in that the person desired, being notified of the call in advance, has an opportunity to arrange his affairs so as to be available and prepared to speak at the specified time.

After the call has been recorded, if the called number has not been furnished, reference is made to the telephone directory of the foreign city on file at the overseas section. In so doing, correctness of names of persons and places can be verified. If the called number cannot be found, however, the call will be passed onward without it, for tracing at the distant terminal or at the office of destination.

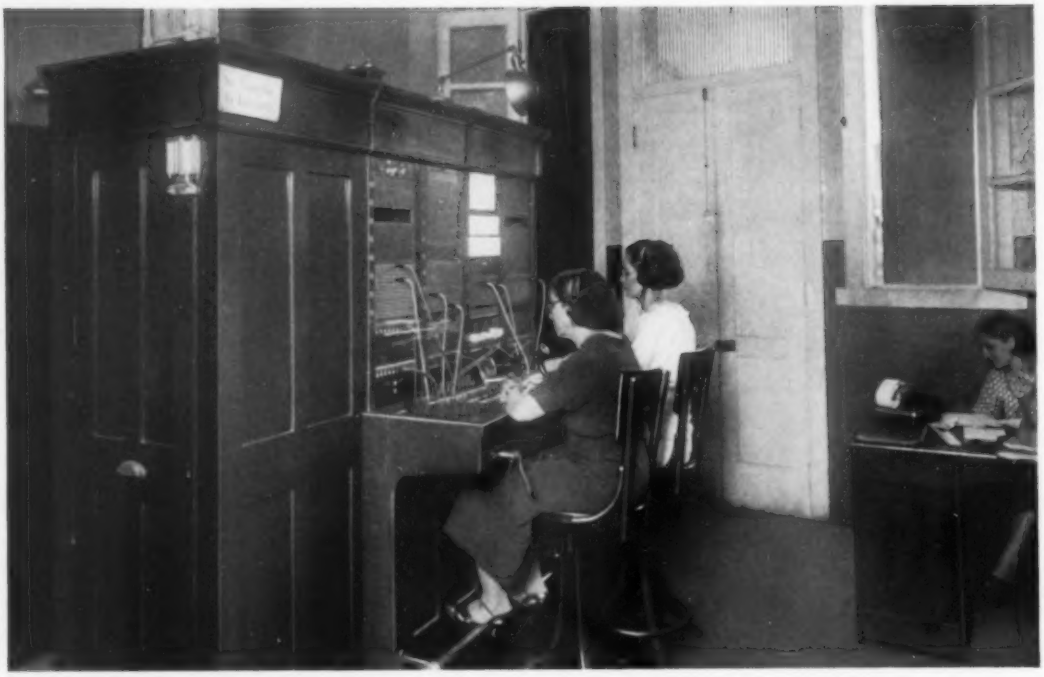
The ticket is then handed to a circuit operator who is handling traffic over the radio circuit required for this call. Her first step is to familiarize herself with the particulars, so that she may deal with it intelligently.

It Reaches a Foreign Shore

As she casts a practiced eye over the ticket, the circuit operator draws on no small fund of geographic and telephonic detail concerning that part of the world with which she works. It is necessary for her to recognize, for example, cities which are generally known in the United States by other than their native names—Vienna for Wien, Leghorn for Livorno, Munich for München. Calls may be filed by either name. The principal central office prefixes in the large cities, the particular way in which street addresses are given in foreign lands, the importance of certain identifications such as the postal district letters in London and the arrondissement numbers in Paris, the various ways in which "Incorporated" in company names is expressed,

A Section of the American Telephone and Telegraph Company's Overseas Switchboard in New York at which Are Handled Calls to Europe, to Bermuda, to the More Distant Countries of South America, and to Ships at Sea.

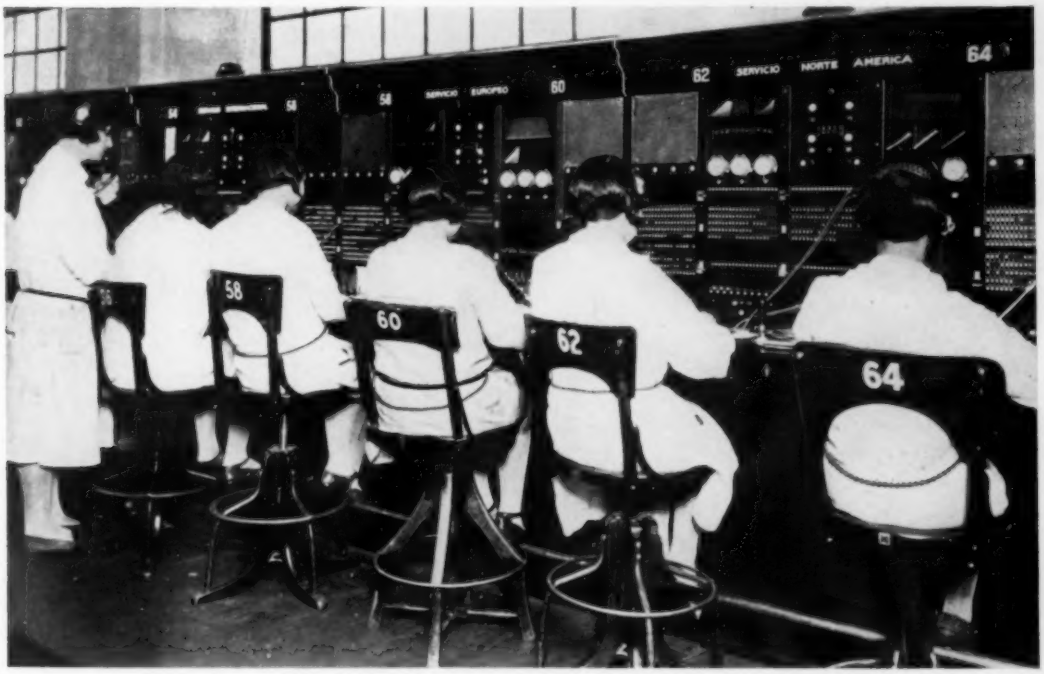
The International Switchboard in London, where Overseas Radio Telephone Circuits Are Linked to the Wire Lines to Other Parts of Great Britain and to the Continent.



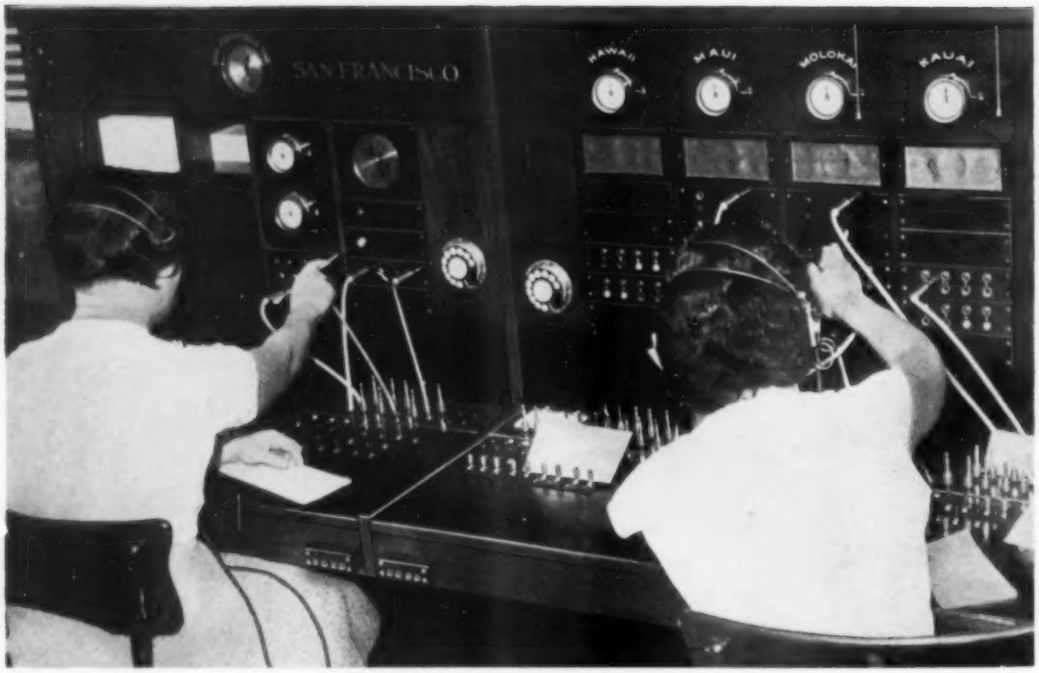
Bell System Overseas Service Reaches Places Small as Well as Large. This Switchboard in Ciudad Trujillo, Dominican Republic, Connects with the A. T. & T. Station at Miami, Fla.

Overseas Positions at the "Interurbain" or Long Distance Office in Paris. There Is Now a Direct Radio Telephone Channel between New York and Paris, in Addition to the Circuits via London.

A Section of the Long Distance Switchboard at Amsterdam, The Netherlands.



Calls to and from North America Are Handled at This Section of the Long Distance Switchboard in Buenos Aires.



HONOLULU CONNECTS WITH THE A. T. & T. COMPANY'S TRANS-PACIFIC STATION AT SAN FRANCISCO AS READILY AS WITH OTHER ISLANDS OF THE HAWAIIAN GROUP.

INTERNATIONAL TELEPHONE CALLS BOTH BY WIRE AND BY RADIO CIRCUITS ARE HANDLED IN THIS LONG DISTANCE OFFICE IN BERLIN.

from the British "Limited" to the Japanese "Kabushiki"—knowledge of these and a thousand other details contributes to the intelligent handling of the call and to the avoidance of mistakes and delays.

The next step in the process of handling the call is to pass the call to the distant side. In the case of all of the overseas services operated by the Bell System, this is done simply by dictating the particulars as they appear on the ticket. Since our overseas calls are dealt with by speech, the question of language comes to the fore. Naturally, if operators in two countries with different languages are to speak with each other, one at least must be bi-lingual. In Europe the general rule among the various telephone administrations is that any international service may be operated in the language agreed upon between the interested administrations. In the radiotelephone services throughout the world, the language to be used is likewise a matter of agreement. As a practical matter, English is used in a number of cases where it is not the native tongue at either terminal. The Tokyo-Shanghai radiotelephone circuit, for example, was operated in English, and certain circuits between South America and Europe are operated in this tongue. Of the twenty-four distant countries or territories in which the Bell System overseas circuits terminate, the native language is English in the case of five, French in two, Spanish in thirteen, Portuguese in one, Dutch one, Japanese one, and Chinese one. All of these circuits, however, are operated in English.

In passing the particulars of the call, our circuit operator resorts to spelling words, letter by letter, when necessary to insure accuracy. As she dictates the call, the operator on the distant side records it on a ticket; at the conclusion, coming as an indication that all of the items have been given, the circuit operator on the outgoing side assigns a serial number to the call which serves thereafter as its identification.

Advancement of the call toward its completion now takes place on the distant side. The objective, of course, is to reach

the telephone at which the person desired may be found, to ascertain if he is available and, if so, to proceed with the establishment of the connection. The exact process of doing this does not constitute a specific operating method, because it is governed by conditions in the country concerned. In most of the countries of the world, the telephone service has developed according to the habits and customs of the people as well as the broad social, economic, and political factors. Differences in organization, the kind and quantity of plant provided, methods of operation, and the philosophy as to objectives naturally produce differences in methods and in service results. The speed with which our overseas call is handled on the distant side will depend largely on the pace or tempo of telephone operations as a whole in the particular country. The various steps may be simple and quick if there are ample trunks and wire circuits directly accessible to the overseas operator, efficient operating methods, well-organized auxiliary services, such as "Information," a maximum of control by the operator actually handling the overseas call, and a general precision in operations by other operators whose work is of a semi-mechanized character. The reverse may be the case if the fundamentals for rapid handling of the traffic are lacking.

The Distant Operator Reports

In due course, the distant circuit operator will have a report on our call. Again using the European services as an example, we may anticipate that the person desired has been reached on about fifty per cent of the calls, and that he will be unavailable on about thirty per cent. On more than ten per cent of the calls, in spite of the care exercised before passing the call, further information is required by the distant side in order to trace the person desired. The first report on the remainder will be of great variety, of which "no reply from the called telephone" will predominate. On the fifty per cent which cannot be completed because of these delaying condi-

tions, further attempts will have to be made from time to time. The extent of this is reflected in the fact that on all European calls, the New York and distant operators deal with each other an average of nearly five times per call.

Relative time of day is of importance in giving reports to the caller. On a call to Manila, for example, the report obtained from the called telephone may be that the called party is not available but is expected about 11 P.M. This report is to be given to the caller, who is perhaps in Boston and who may not know the exact difference in time. The general practice on such a report is for the Manila operator to quote the report in terms of her own time; the San Francisco overseas operator notes it on her ticket in terms of Pacific Standard Time and in giving the report to the caller makes such changes as may be required. To facilitate this, small tables showing relative time of day in the various countries at which our overseas circuits terminate are issued to the overseas operators from time to time. Due to the Daylight Saving Time changes and cases where countries change their legal time, this table requires corrections from ten to thirteen times a year.

When both of the persons involved are available, the circuit operators at the two terminals proceed with the establishment of the connection on their respective sides. Certain technical features enter into this apparently simple step and influence the detailed routine. During the time that the two circuit operators were dealing with each other, the technical operators, watching the meters which indicate the outgoing and incoming volume levels, were able to set the amplification and other factors at a fairly constant value, since the operators were close to the terminals and spoke constantly in the same tone of voice. The preparatory work on the land-line side was done independently by report operators, so that until the land line is connected to the radio circuit there is no indication to the technical operator as to what changes in adjustments will be required for the over-all connection. Hence it is the practice,

when all is ready, for the circuit operator on the incoming side to connect the land line to the radio circuit upon order of the operator on the outgoing side, whereupon the latter addresses the person at the far end of the connection. From his response to the operator the technical operator on the incoming side makes the changes in adjustments necessary to compensate not only for the land-line conditions but the voice of the particular speaker. Upon obtaining this response, the circuit operator on the outward side has a practical speaking test and, if the results are satisfactory, she connects the caller to the radio circuit, thus completing the connection. The technical operator on the outward side is then able to adjust his end of the circuit with the assurance that the proper adjustments on the distant side are already made.

The Circuit Is Made-to-Order

During the course of conversation, both the technical and traffic operators are on the alert to take action should any difficulty develop. If, as often happens, a second person at one of the telephones talks on the connection, and if his or her voice in point of volume is substantially different from that of the previous speaker, the technical operator's meters indicate this and he raises or lowers the amplification to the proper level. At the conclusion of conversation, the two circuit operators meet on the circuit, confirm that the connection may be released, and proceed with other calls. The technical operator alters the circuit adjustments once more to meet the speech conditions of the two operators.

Although marked advances have been made in improving radio communication, disturbances from atmospheric conditions and from invisible magnetic storms—believed to be the result of active spots in the sun—make these circuits less stable than wire circuits. These disturbances may make the radio circuit temporarily unsuitable for traffic, in which case it is taken over by the technical operator for such adjustments as can be made

or, if natural forces are too strong, until the ether storm subsides so that standard qualifications are again met.

The overseas services have shown marked and continuous improvement since their inauguration. When the service with Europe was opened eleven years ago, the average interval to complete a New York-London call was in the order of forty-five minutes; the speed on similar calls now averages between ten and twelve minutes. Many calls between terminal cities are completed in one or two minutes, the caller being at the telephone while attempt is made to complete the call. Refinements of methods and the development of special skill and experience as well as technical improvements in facilities have contributed to better service.

The "Christmas Rush" Starts Early

No story of the handling of the overseas traffic would be complete without mention of the exceptional conditions that prevail during the Christmas holidays. It is at that time of year that thoughts turn to families and friends separated by distances and the telephone offers the means to exchange greetings and to hear the actual voice of loved ones. The booking of overseas calls for completion on December 24 and December 25 starts early; usually the first call may be expected by the end of September. As the season draws near the number of such calls increases. On one occasion a call was booked by letter from a man in a foreign country who had not yet left home but who wished to speak with his family on Christmas from New York.

The really heavy filing begins about December 22. Last year in the transatlantic service nearly sixty-five per cent of the calls wanted on Christmas Eve and about eighty per cent of the calls wanted on Christmas Day were filed in advance. The total demand for overseas services was about four and one-half times that on a normal day, with one of the services running nineteen times normal. Plans for handling this traffic

were made many months in advance and general international consultations were held by telephone in perfecting a common understanding of these plans. All available radio facilities were scheduled for continuous operation until the traffic should be cleared. Operating staffs were trained in the special procedures devised for dealing with a heavy overload of traffic. But one fundamental factor could not be anticipated—whether radio conditions would be favorable.

On the transatlantic route, due to the experience in previous months it had seemed likely that one of the periodic magnetic storms would disturb radio conditions about December 20. But that date came and passed without sign of difficulty. The question then was whether it would hold off until after Christmas. It didn't! About noon of the 24th, intermittent trouble began to disturb the London and Paris circuits; by mid-afternoon there was no longer any doubt. Just as the Christmas Eve peak of traffic arrived, between 5:00 and 7:00 P.M., the overseas operators were struggling with only half the normal facilities and several times the normal number of calls. Late in the evening, conditions improved rapidly and the traffic started to move more nearly in accordance with its usual speed. Christmas Day was relatively free of radio disturbances and the heavy traffic not only at New York but at Miami and San Francisco was kept moving by augmented overseas staffs.

In the course of operations which involve such direct and personal relations between overseas operators in different countries, there are inevitably causes for misunderstandings; occasions when it seems as though a call is not proceeding just right on the distant side. Both operators are working against time and under pressure from the users of the service and neither is in a position to comprehend fully the conditions which each is meeting on her own side. In some cases the language problem is involved and it is difficult to understand and to be understood.

To the great credit of these young women, both here and abroad, it may be said that in the entire history of these serv-

ices only the most harmonious relations have been maintained. The patience, tolerance, and philosophy with which difficulties are met and overcome speak well for the self-discipline and earnestness of these operators.

With them, the call's the thing. This point of view arouses a strong sense of mutual responsibility and stimulates a high degree of coöperation. Without such a spirit, the service would descend to the level of routine; with it—well, one of the daily stories will illustrate the difference. Naturally, the identifying names and places as here related are fictitious, but the situations are factual.

The Operators "Get Their Man"

It is three o'clock in the afternoon, a recording signal appears at the overseas switchboard at New York. The overseas operator answers and receives from Mr. Blank, a mid-town subscriber, what looks like a very simple call; he asks to speak with a Mr. Dash at a certain hotel in London, adding that if Mr. Dash is not at the hotel he might be reached through the North German Lloyd office in Southampton. These particulars are passed to London, and nine minutes later the report is received that Mr. Dash has left the hotel and it is believed that he has gone to Yorkshire. The Southampton telephone, which London found listed as Norddeutscher Lloyd Bremen, does not answer, the time being shortly after eight in the evening in England. From a strictly routine view, this report might finish the call, but telephone operators don't quit so easily. Besides, the directions and the report suggested that the call might be of especial importance. When the overseas operator gives the report to the caller, however, he shows no undue concern but merely asks that she try to reach Mr. Dash at Southampton about four o'clock the following morning—which would be 9 A.M. in Southampton—and, since he would not be in his office until 9 A.M. in New York, she should wait until then to complete the call.

At four in the morning, London reports that Mr. Dash is unknown to Norddeutscher Lloyd in Southampton and they can be of no assistance, therefore, in tracing him. When the caller is informed of this upon his arrival in his office shortly after nine o'clock, he tells the overseas operator the whole story. Mr. Dash intends sailing to New York on the Bremen, leaving Southampton tomorrow. It is vital to speak with him before he embarks, as events have made it unnecessary for him to come to America. The overseas operator thinks quickly: there was the Yorkshire angle. Why Yorkshire? She asks a question; the caller says perhaps Mr. Dash is at his brother's place, but he doesn't know where in that county of a hundred or so towns the brother may live. "We will try to locate him," says the overseas operator and a moment later she is relating the circumstances to her colleague abroad. London calls the hotel and talks to the hall porter. Does he remember Mr. Dash? Has he any idea as to where in Yorkshire he might visit? This alert functionary who handles the hotel mail thinks a moment. Yes, he noticed a letter from Coddingdame-Ribblesdale—"the wife 'as relatives there, miss, and it took my fancy to see the nime." That's a clue, but it seems to vanish as the directory for that district discloses no listing under the surname of the elusive Mr. Dash. The post office might know, and within a few minutes the London overseas operator is inquiring of the Coddingdame-Ribblesdale postmistress if she knows anyone by the name of Dash. "Down in the country," she says, "but the postman will pass the place in his late delivery and can mention the telephone call from America . . . No, miss, there's no other way . . . Yes, miss, we'll make a point of it."

At four the following morning London tells New York that Mr. Dash has been located at the Southern Hotel in Southampton but is not available at present. She adds that the tender taking passengers to the Bremen, which will anchor off the Isle of Wight, will leave the dock about 12 Noon. That will be 7:00 A.M. in New York, but Mr. Blank has given no telephone

number other than that at his office, which may not open until two hours too late. The overseas operator, with the help of others, searches for the caller's possible home telephone: nothing listed in Manhattan by his name. He may live in an apartment house or hotel, but that would be hopeless to find. Hundreds of thousands of persons working in New York live in suburban towns, and with this possibility as a last resort the overseas operator, assisted by others, starts a search through the various directories of Westchester County, Connecticut, and Northern New Jersey. At last! A listing is found in a New Jersey town which corresponds with the name and initials of the caller. The supervisor considers a moment, for it would be serious to arouse a wrong person at that hour of the morning. "Try it," she says. A sleepy voice answers the ring. "Are you the Mr. Blank who is calling Southampton?" "Yes," he replies. He is tremendously relieved that Mr. Dash has been located. "Keep after it, operator, will you? It is most important that I catch him before he leaves."

Within an hour London reports again. Mr. Dash did not return to the hotel but he has been reached at the dock. The completion of the call is now a matter of routine. In a few minutes Mr. Dash's plans are completely changed and Mr. Blank retires for a final nap, thinking of the chase around England. "Well, those girls certainly get their man!—but now, how did they find *me?*"

Another recording signal at Long Distance: "Overseas operator."

EDWARD J. PADMORE

Dealer Identification Through Classified Telephone Directories

MAGAZINE readers and radio listeners without number have noted in advertisements and have heard over the air the statement, "For the name and address of the nearest dealer, look in your classified telephone directory." That reference phrase is the keynote of a specialized Bell System directory service which has demonstrated an increasing usefulness during the decade of its existence. First developed on a national scale by a centralized organization in 1928, Dealer Identification Service has proved its value not alone as a convenience to telephone subscribers and the public at large, but no less as a factor in promoting efficiency in the retail distribution of goods and services. It provides the vital link in the chain of information connecting manufacturers and consumers by answering the important "Where To Buy It" question.

Classified telephone directories have always served as "buying guides," since in them the local merchants and purveyors of services are listed under classifications generally descriptive of types of business or commodities or services. As the nation expanded industrially, the distribution and advertising of branded or trade-marked goods and services on a nationwide scale greatly increased. Until recent years, there was no sure and ready means whereby a prospective purchaser could find the local dealer, agent, or representative of a *particular* product or service *by its advertised or brand name or trade mark.* In most cases, a person who wanted to buy something of this description had either to "write for booklet and name of nearest dealer," or to "shop around" locally until he found what he sought.

There were two serious disadvantages in this situation. In

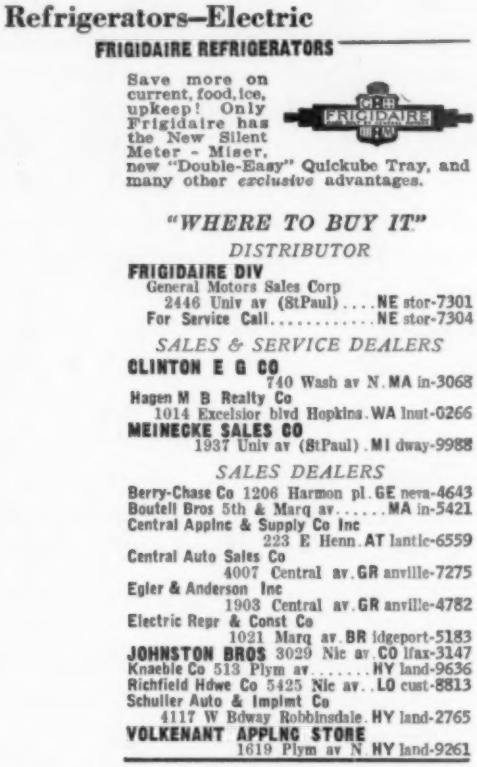
the first place, it was a real inconvenience to individuals who, having made up their minds that they needed or wanted certain specifically identified things, had difficulty in finding where to get them. Second, it was a weak spot in the nation's economic life, since dollars spent for national advertising, having created a desire for the purchase of the advertised product or service, could not in most cases "follow through" by directing purchasers to the place where that desire might be gratified.

The Bell System's classified telephone directories, long familiar and useful to millions of people, were the obvious and logical medium for filling in this gap—by providing, a wholly new kind of directory service, whereby local dealers could identify themselves *under the brand or trade-mark name* in every community in which the product or service was represented and in which classified books were distributed.

It was apparent that benefits would accrue, from such a directory service, to three groups: first, of course, to consumers —the public—through the ease with which they could locate the local outlets of the brand-named or trade-marked articles or services they wanted; and to advertisers and to their local dealers or representatives through the increased effectiveness of national advertising when localized by inclusion of some such directional reference as that quoted at the beginning of this article.

These three groups mutually would benefit from a service designed primarily to increase the usefulness of the classified directories to telephone subscribers and the public. But investigation soon revealed that this increased usefulness could be brought about only with the participation and active cooperation of national advertisers—manufacturers of branded or trade-marked products and their advertising agencies—and of their retail dealers and local representatives. The public would be passive beneficiaries of the introduction of the additional buying service in the "yellow pages" of their telephone books.

Prior to 1927, as the result of analysis of the then existing situation and of the opportunities for remedying it through the System's directory organization, a merchandising plan was developed by one of the Bell Companies, in coöperation with the American Telephone and Telegraph Company, to be presented to manufacturers and other advertisers, which would make



Refrigerators—Electric

FRIGIDAIRE REFRIGERATORS

Save more on current, food, ice, upkeep! Only Frigidaire has the New Silent Meter - Miser, new "Double-Easy" Quickube Tray, and many other *exclusive* advantages.

GM FRIGIDAIRE

"WHERE TO BUY IT"

DISTRIBUTOR

FRIGIDAIRE DIV
General Motors Sales Corp
2446 Univ av (StPaul) . . . . NE stor-7301
For Service Call. . . . . NE stor-7304

SALES & SERVICE DEALERS

CLINTON E G CO
740 Wash av N. MA in-3068
Hagen M B Realty Co
1014 Excelsior blvd Hopkins. WA lnut-0266
MEINECKE SALES CO
1937 Univ av (StPaul) . MI dway-9988

SALES DEALERS

Berry-Chase Co 1206 Harmon pl. GE neva-4643
Boutell Bros 5th & Marq av. . . . . MA in-5421
Central Applnc & Supply Co Inc
223 E Henn. AT lantic-6559
Central Auto Sales Co
4007 Central av. GR anville-7275
Egler & Anderson Inc
1903 Central av. GR anville-4782
Electric Repr & Const Co
1021 Marq av. BR idgeport-5183
JOHNSTON BROS 3029 Nic av. CO lfax-3147
Knaeble Co 513 Plym av. . . . . HY land-9636
Richfield Hdwe Co 5425 Nic av. . LO cust-8813
Schuller Auto & Implmt Co
4117 W Bdway Robbinsdale. HY land-2765
VOLKENANT APPLNC STORE
1619 Plym av N. HY land-9261

An Example of Dealer Identification Service as Millions of Telephone Subscribers Find It in Their Classified Directories: Brand Name, Trade Mark, Descriptive Text, and List of Local Representatives.

possible local dealer identification with brand-named and trade-marked goods and services in every community served by a classified telephone directory.

This merchandising plan was called Trade Mark Service, because it provided for an illustration of the trade-mark or

distinctive insignia of the brand, with a few words of text under the directory classification descriptive of the product or service, and for the listing immediately below that of local dealers or representatives, with their addresses and telephone numbers.

In 1934, a simpler form of dealer indentification was introduced, eliminating the illustration and text but retaining the brand name under its appropriate heading. While less prominent, this junior form of the service gives the same buying information to the public and permits the local dealer handling several brands to identify himself with all of them at very moderate cost.

It is usual for manufacturers and other national adver-

An Example of the "Junior" Form of Dealer Identification Introduced in 1934.

tisers to bear the expense of Dealer Identification Service under a coöperative plan with their dealers or local representatives. One of the very practical advantages of the service is that it need be purchased only in classified directories serving the communities where the product or service is obtainable. Being thus directly keyed to local distribution, dealer identification carries with it none of what advertisers know as "waste circulation."

As originally developed, the plan did not make provision for manufacturers to purchase the service to match their distribution either nationally or sectionally, since each of the Bell Companies undertook to offer the service only in its own classified directories and to manufacturers and dealers located in its own territory. The need for some nation-wide arrangement became obvious almost immediately, and each Company then undertook to act as sales agent for any or all of the Bell Companies, so that manufacturers could sign one contract

for the service in any number of classified directories serving communities where they had distribution.

As experience demonstrated the great possibilities and the wide potential scope of the service, it also disclosed the need for one central organization to carry it to its fullest development: to analyze directory "coverage" (distribution), to undertake sales plans, to carry on advertising programs, to work closely with manufacturers and their advertising agencies. Ten years ago, in 1928, the present Trade Mark Service Division of the American Telephone and Telegraph Company was organized to do these things on behalf of the Bell Companies and to arrange with manufacturers and others for the inclusion of dealer identification in the classified directories of all companies.

Experience gained through the ten years since the organization of this centralized group has proved very beneficial to advertisers, particularly those who include a definite phrase in their adverstising copy or in their radio programs referring readers or listeners to the classified telephone directories. Today such well-known advertisers as Westinghouse, Stromberg-Carlson, General Electric, DeVoe and Raynolds, Packard, Goodyear, Remington-Rand, Hewitt Rubber, Zenith Radio and dozens of others refer prospective customers to these brand names, as listed in the classified directories, for the names, addresses and telephone numbers of their nearest local outlets. Some of the insurance companies help to insure their advertising by including a "classified" reference telling prospects how and where to find the nearest agent. Such "Where To Buy It" references as the four illustrated add strength to good creative advertising copy.

This directional feature in advertising is bringing customers into the stores of local merchants and increasing the service value of the classified directories, which today are used by more than 90 per cent of all telephone subscribers to help them

CLASSIFIED TELEPHONE DIRECTORY
186 RAD—RAI
Radio Sets—Retail—(Cont'd)
Radio Sets—Retail—(Cont'd)
Railroad Contractors.
Railroad Equipment.
Railroads.
Refrigerators—Electric
Refrigerators—Gas—Re
Refrigerators—Gas—W
Refrigerators—Ice—Mf
Refrigerators—Ice—Re
Refrigerators Servic
Radio Sets—Wholesale.
"WHERE TO BUY IT"
DISTRIBUTOR
DEALERS
PHILCO
ZENITH
Nuremberg Earlton
WILL THEY FIND your trademark and dealers here?
DO you make it easy in every city for prospects to find your product or service? You can do so—in Classified Telephone Directories. They are the popular buying guide throughout the nation. They are available everywhere—in homes, in places of business, in telephone pay stations.
Many well known concerns have been quick to capitalize this feature. Let us show how the service can benefit your business.
Trade Mark Service Division, American Telephone & Telegraph Company, 195 Broadway, New York (EXchange 3-9800) or 311 West Washington Street, Chicago (OFficial 9300).

An Advertisement of Dealer Identification Service Published by the A. T. and T. Company in Magazines Reaching Manufacturers and National Advertisers.

Painters and Plumbers are easy to find in your Classified Telephone Directory.

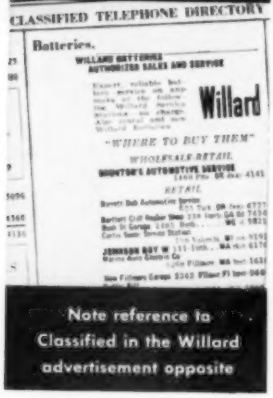
So through the alphabet—Carpenters, Contractors, Electricians, Roofers, etc.

Also dealers of advertised brands—such as American Radiator, Barrett, Carrier, Delco-Heat, De Voe, General Electric, Holland.

Save time and trouble—look it up in your Classified.

One of the Series of Advertisements Published in General Magazines of National Circulation Emphasizing the Convenience of the Classified Telephone Directory.

18-second
man hunt
CLASSIFIED
TELEPHONE
DIRECTORY
How quickly can you locate a dealer of some advertised brand? It's just a matter of seconds, when you use the Classified Telephone Directory. See the simple example below.



Another of the Same Series, Calling Attention Also to a Manufacturer's Advertisement on the Facing Page. (All the Advertisements Shown Are Much Reduced in Size.)

Willard Batteries Give Protection to Millions

"When a transformer 'goes out' or 'hot' wires are crackling all around, we trouble shooters can't afford to lose any time. A whole community may be depending on us for light and power.

"To be on the job quickly we need fast-starting service cars . . . and powerful search-lights to locate the trouble-area. That takes a dependable battery with plenty of reserve capacity. So we use the *best* there is—Willard."

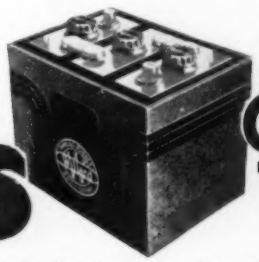
* * *

A "Heavy Duty" Willard will give quicker starting in *any* weather. It will take care of the radio and all the electrical gadgets on your car and yet its average life in service is nearly twice that of an ordinary battery. More car owners and more car manufacturers choose Willard because experience has proven Willards not only last longer but COST LESS TO OWN. Protect yourself—buy a Willard.

WILLARD STORAGE BATTERY COMPANY • Cleveland • Dallas • Los Angeles • Toronto, Canada

IF YOUR CAR WON'T START—look in the yellow pages of your phone book under "Batteries" for the names of Willard Dealers—ready and willing to help you. **Willard**

Willards Cost Less To Own



Because they . . . Last longer . . . Crank faster . . . Don't let you down

This Manufacturer Makes a Point of Referring Readers of His Advertisement to Their Classified Telephone Directories to Locate His Local Dealers. The A. T. and T. Company Advertisement at the Left, Which Also Appeared on the Opposite Page of the Same Magazine, Refers to the Manufacturer's Advertisement. This Carefully Arranged "Tie-in" Is Mutually Beneficial.

"I easily find who sells Westinghouse products"

Another Westinghouse Product enters Classified Directories

—in cities of 50,000 and over

● Westinghouse knows that "Where to Buy It" Service builds sales for its outlets. The results of showing a number of Westinghouse products in the 'yellow pages' at various classifications have proved it.

The Company now adds another product—Westinghouse *Home-Proved* Laundry Equipment. This trade mark will appear in all of the classified telephone directories serving the 200 largest cities throughout the country.

If you handle Westinghouse *Home-Proved* Laundry Equipment, see that your store, address and telephone number are listed under this particular Westinghouse trade mark. Westinghouse cooperates with you by paying for the one-inch Trade Mark heading. You pay only for your listing—a few cents a day.

To get your share of Westinghouse prospects, just call your local telephone business office for full details.

CLASSIFIED TELEPHONE DIRECTOR
Washing Machines
WESTINGHOUSE HOME-PROVED LAUNDRY EQUIPMENT
Women conducting nation-wide home-proving tests report clothes are cleaner, look better, launder easier, last longer when washed and ironed the Westinghouse Way
"WHERE TO BUY IT"
Anderson & Jones 610 High
HARRISON B C 176 Chestnut
Miller T W 556 Ridge
SMITH B SON 1237 Main
Yates G W 416 Pearl
DE nter-1234
SP ruce-5432
WA lnut-6789
WA ln-6229
CA nal-91

ORDER YOUR LISTINGS NOW

A Dealer Identification Service Advertisement Addressed to Dealers and Published in Magazines Reaching Retail Merchants Throughout the Country.

DEALER IDENTIFICATION

North America policyholders throughout the world, the policies of this oldest American fire and marine insurance company mean dependable protection, tried and proved for 143 years.

North America Agents may be found in the Classified Telephone Directories under the name and identifying "Eagle" emblem of this company.

not investigate this modern method of duplication? **Write A. B. Dick Company, Chicago, or see classified telephone directory for the local address.**

EDISON-DICK
MIMEOGRAPH

Look for this symbol in your phone book when you want first-quality tires — sold and serviced by Seiberling independent dealers only.

NOW IS THE TIME

We invite you to use York as a yardstick of the latest and best in air conditioning and refrigeration for your business. Write for the book below. There are York Headquarters Branches and Distributors throughout the world. For one convenient to you look in the Classified Section of your phone book.

York

EXAMPLES OF REFERENCES TO DEALER IDENTIFICATION IN CLASSIFIED TELEPHONE DIRECTORIES, CLIPPED FROM ADVERTISEMENTS IN MAGAZINES OF NATIONAL CIRCULATION.

with their buying problems. Surveys from all parts of the country prove this general average usage.

One of the most difficult things to prove in the promotion and sale of any product or service is the actual results of advertising. Every advertiser, large or small, is always interested in how his printed advertising or radio program is "going to pull." Yet it is difficult to get any "yardstick" which will accurately measure advertising results. Surveys made for and by many clients have proved the results flowing from the use of Dealer Identification Service. Likewise, unsolicited testimonials of its usefulness indicate benefits to dealers, manufacturers, and the public.

The advertising manager of a well-known insurance company wanted to know the value of this service to its local agents, and asked for proof of results. A survey made among 828 agents in the forty-eight states showed that twenty-three per cent received inquiries, thirteen per cent settled claims, and twenty-one per cent secured orders from their listings under the four kinds of insurance they sell. These results were far beyond the advertiser's expectations.

A large coal company marketing a trade-marked brand of coal asked, "What results are we getting from this form of advertising?" The dealers in fourteen representative cities were personally interviewed, and again "dealer identification" proved its case. Forty per cent of the dealers reported orders, all traceable to their listings under that brand of coal in local classified directories.

A survey made by a tire manufacturer among 229 dealers (114 by personal interview and 115 by questionnaire) indicated that sixty per cent considered the service valuable, and thirty-six per cent reported sales traceable directly to their brand name listings. Yet of the 114 dealers personally interviewed, only thirty-nine per cent were primarily tire stores.

A firm of haberdashers in a southern city which believes in classified telephone directory advertising and which listed its

store under a well-known brand of shirts under the classification of "Haberdashers," reports: "In one instance we know of a woman that spent $17.50 for merchandise with us." She looked in the "yellow pages" for the particular brand of shirts her husband wore, went to the store listed, and got them. Many similar statements from local dealers and from manufacturers only add to the fact that this directional service in classified directories has proved a convenience to the public, has aided merchandising, and has helped advertising to do a better job.

During this ten year period a consistent national advertising campaign has been conducted by the central organization in more than a dozen executive, sales, advertising and dealer magazines to aid in the promotion of dealer identification through classified directories. A special phase of this program has been directed to the public through four widely circulated general magazines to promote greater use of classified directories.

This national advertising program is further enhanced by a coördinated merchandising campaign whereby reprints of every "classified" advertisement are furnished to all Bell Companies for the use of their local directory advertising salesmen. They are also used as direct mailing pieces to prospective clients, and by the manufacturers themselves, who send them to their dealers and distributors to stimulate greater representation under their own trade marks in local classified directories. To supplement the national advertising campaign, the Bell Companies also carry on local classified directory advertising campaigns to increase further the usefulness and service value of every classified telephone directory.

A special feature of the national advertising campaign is the arranging of "tie-in" advertisements with clients—placing the classified directory advertisement which illustrates the client's use of dealer identification on the same page or "spread" of the magazine where the client's own advertisement appears and

in which the client includes a phrase referring readers to the "classified" for the name, address, and telephone number of the nearest dealer. This definitely focusses attention on both advertisements and has proved to be a buying aid in selling.

As a result of the ten years of progress with dealer identification through classified telephone directories, the service value of "The Nation's Buying Guide" has been greatly improved. Today the number of well-known brand-name listings, together with their local outlets, is steadily increasing. Manufacturers have found that the "yellow pages" of telephone books have a definite place in advertising budgets and that dealer identification helps to direct customers to their dealers' stores. Proof of this is the fact that many concerns making several products under the same brand name are now identifying each separate product in the classified directories to match its distribution. Among those who have such multiple dealer identification in classified telephone directories are: Kelvinator with 12, Frigidaire with 6, Westinghouse with 9, General Electric with 7, Johns-Manville with 5, Remington-Rand with 12, International Business with 13, every one of which is helping people with their buying problems and at the same time making the classified telephone directory a better medium to serve the public. All of the Bell Companies have contributed to the success of this plan for bringing together buyers and sellers of branded merchandise locally, sectionally and nationally.

C. B. SMYTHE

Training of Plant Department Personnel

THE telephone job in the industry's pioneer years, as compared with the complexity of the job today, was a relatively simple thing, requiring little specialized knowledge and only limited skills. Equipment was simple and few special services existed. There were fewer classifications of work, men were more readily interchangeable between assignments, and —most pertinent to this discussion—men could master their work without planned training; could, in fact, learn by sheer exposure. In the early days every man started from scratch, and made his own way, often floundering, but—due to the comparative simplicity of the problem—usually succeeding in becoming a "good telephone man."

Today our national life is complex, and we are surrounded by the highly technical and complicated devices which make that civilization possible. The Bell System covers the nation with a wide variety of services "hand-tailored" to the needs of present-day living. The instrumentalities for these services are many and complicated—cable, radio, teletype, carrier, dial equipment, etc.—and the skill and technical proficiency of the men who operate and maintain this apparatus must be of a very high order.

Starting from scratch is no longer possible, and the System has grown too far to permit "growing up with the business." Floundering must be avoided, not only from the standpoint of efficiency, but because final success is virtually impossible without careful advance planning, coaching, and training. The System must therefore *make* its "good telephone man."

The handling of complex apparatus and equipment manifestly requires adequate knowledge and understanding. Installation, operation, and maintenance necessitate a high degree

of specialized skills. Because the services offered by the Bell System are many and varied, and because fine precision apparatus is necessary for these services, employees with a high level of knowledge and skill are required.

This specialized knowledge and these particular skills are not available elsewhere, and it is the responsibility of the Bell System to impart them to its people within the confines of its own business. And they must be so imparted—accurately and rapidly—if the plant is to be operated with the efficiency necessary to give telephone service as it is today.

The Training Program

The formulation of training programs requires a careful analysis of the men to be trained, and of the scope of knowledge and type of skill necessary to proper performance of each job. This means a thorough study of the job itself, and a decision as to the minimum standard of accomplishment that can be accepted at any stage of the learner's progress.

Broadly considered, training may be divided into craft training and supervisory training. In the crafts, a knowledge of proper methods of performing manual manipulative work is a primary concern, together with a skill which will result in correct and reasonably rapid performance. Most of the knowledge necessary is factual and not subject to opinion, so that the educational method to be employed is naturally informational. That is, any instructional method which can present facts in such a manner that they can be properly understood and assimilated, can be used. Which of the available techniques is actually chosen is a matter of efficiency—measuring the effectiveness of the method against its cost. For example, a more rapid and effective training job can be done where an expert instructor is available and where suitable demonstration apparatus and school facilities can be used, as may be seen in the accompanying illustration of station installation training. However, if the geographical distribution of the men to be

trained is such that a considerable travel expense would be involved in bringing men to a school, it may be more economical to train on the job if the longer time (which is, of course, an expense item) is more than offset by a saving in travel expense.

Craft Training

There are several types of material which must be presented, dependent on the status of the individual. The new man, and often the recently transferred one, naturally requires orientation on his new job. He must get a general picture of the nature of the telephone business and its policy, and must understand wherein his job fits with respect to the main objectives of the business. He must also be given enough technical knowledge to understand the operations he is to perform, and must acquire sufficient skill to be able to perform these operations with safety to himself and to the service, after which he may proceed on actual productive work, acquiring more skill and the additional knowledge that comes from experience.

Those men who have passed the first stage, or initiation period, will require additional training as they progress to more and more difficult parts of the work, and as they are given more complete responsibility for planning and deciding questions which involve some judgment.

Even the older men who have attained top rank in their crafts may need occasional retraining on specific points where, either because their assignments may include a given point but seldom (as in the case of installation of special equipment, such as amplifying devices for persons with impaired hearing) or because (as may be true in such common operations as soldering) their former knowledge may have been forgotten or their skill become rusty.

All of the men must be kept abreast of advances in the telephone art. As new equipment and improved methods are introduced, it is essential that the men who are to use this equipment and follow these methods be properly instructed. In

the Bell System this is a very considerable part of the training work, applying in times of expansion and depression alike.

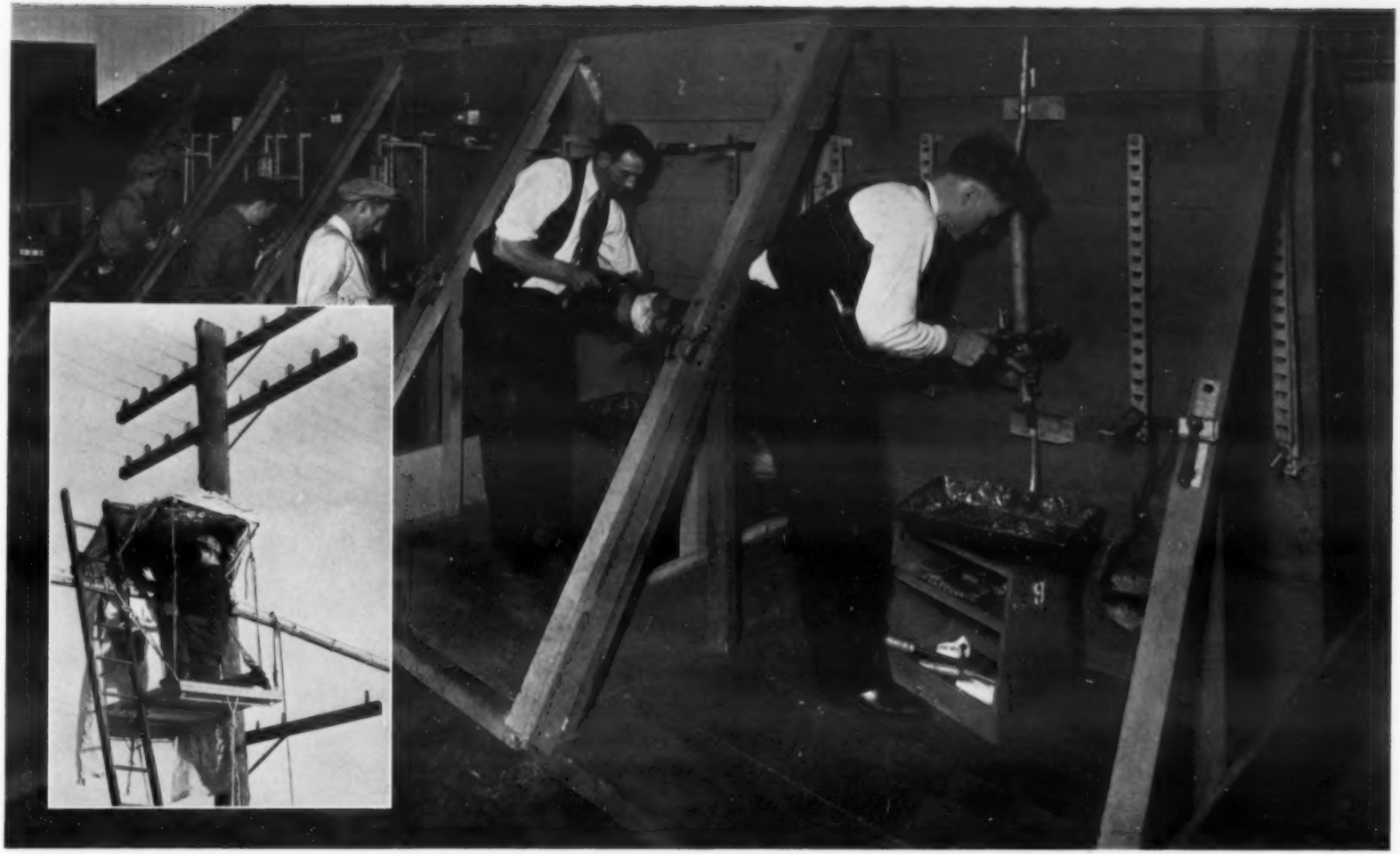
Supervisory Training

With the foremen and other supervisory people, training must be designed to inculcate judgment and reasoning ability, since these men have the responsibility for making independent decisions, and cannot function by rule and rote. The training procedure must therefore be developmental rather than informational. That is, the training approach is not to present conclusions as to the proper functioning of a supervisor, but to present cases and data for consideration, and then to assist him through a process of reasoning which will bring him, step by step, to the logical conclusion based on the data, so that in fact he makes his own decision.

At different levels the scope of this training and its manner of application may be different, though the principle remains the same. The men under a foreman ordinarily are of the same craft, which is almost always the craft in which the foreman made his mark as a workman. He must, of course, be kept up to date in the work of this craft, through a process of training virtually identical with that used with the workmen themselves. In addition, he has certain chores of his own—the preparation of reports, making of inspections, etc.—where the informational approach can best be used. But his chief responsibility is as a leader of men: planning their work, maintaining their morale, safeguarding them, and insuring that the quantity and quality of their work is up to standard.

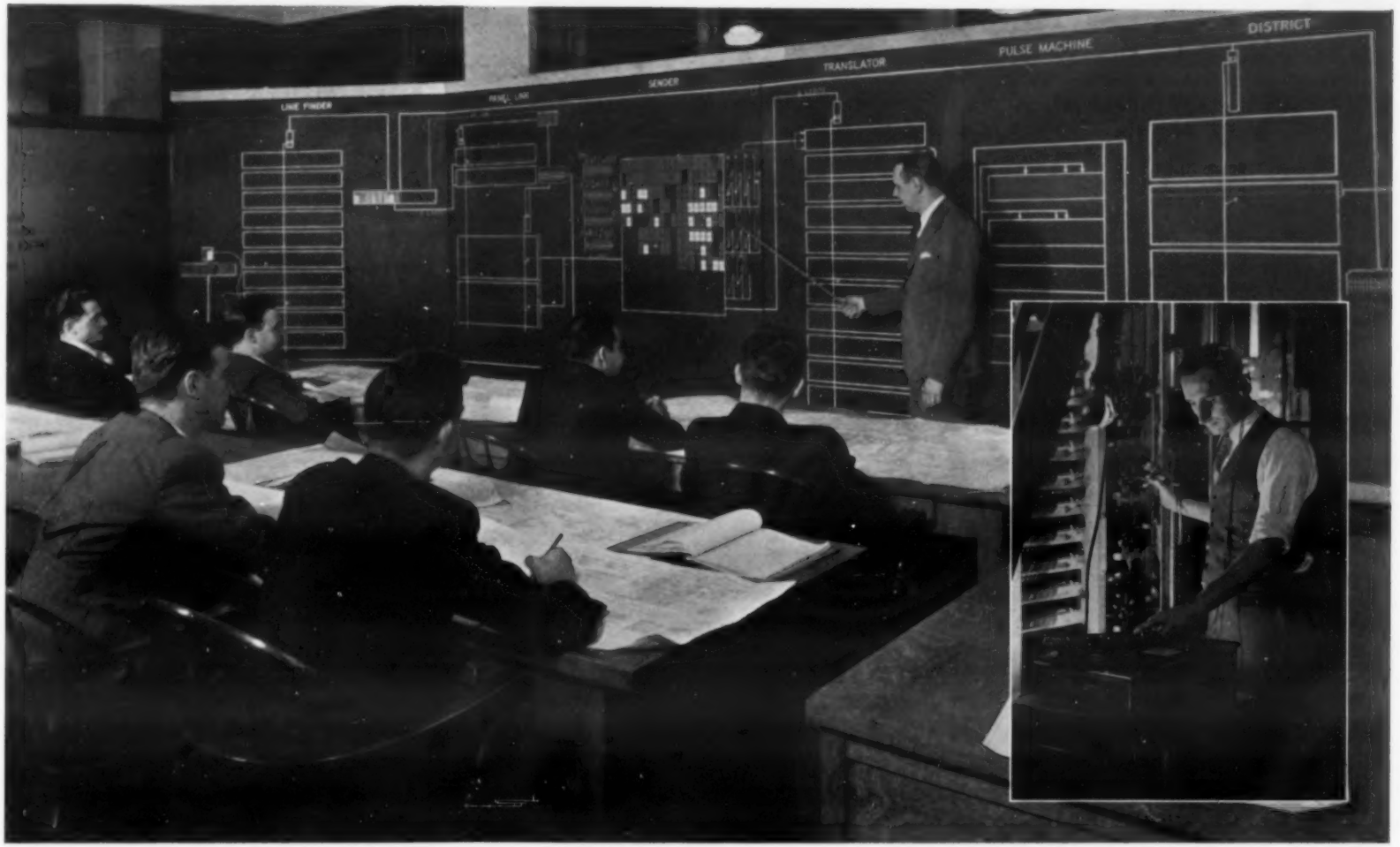
As consideration is given to the higher levels in the organization, a broadening of the variety of work supervised is found and a lesser requirement for an intimate meticulous knowledge of the craft operations. At the same time, the responsibilities for good leadership become heavier, and the importance of each decision greater as more men are affected by these judgments.

SOME OF THE 10,000 MEN IN THE CONSTRUCTION FORCE ARE LEARNING FROM WORKING MODELS WHICH ILLUSTRATE HOW "TRANSPOSITIONS" ARE MADE.



A School for Cable Splicers. There Are About 6,500 Men in the System's Splicing Force Who Need This Knowledge and Skill. Insert: Splicer at Work on Aerial Cable.

IT TAKES A FORCE OF 23,000 TO INSTALL AND MAINTAIN BELL SYSTEM TELEPHONES. THE MEN SHOWN HERE ARE STUDYING THE RECENTLY INTRODUCED "ANTI-SIDE-TONE" EQUIPMENT. INSERT: THE INSTALLER PUTS IN ANOTHER TELEPHONE AND MEETS THE NEWEST CUSTOMER.



There Are 15,000 Men Who Care for the Equipment in Telephone Central Offices. Shown Here Is a School where Some of These Men Are Trained on Panel Dial Apparatus. Insert: Applying This Knowledge on the Job.

on Panel Dial Apparatus. Insert: Applying This Knowledge on the Job.

Some of the 6,000 Test-desk Men Learning Their Work by Seeing and Hearing. The Instructor Is Acting as the Customer in a Simulated Case of Trouble. Insert: Working at a Test Desk.

About 7,500 Supervisors Are Required in the Plant Department. This Group Is Receiving Training as Instructors, One Man Acting as Teacher and Another as Student, While the Others Make Notes on the Teaching Method Used.

Therefore, training efforts are almost entirely developmental in the higher supervisory levels.

The Informational Method

The problem, then, is to consider craftsmen at various stages of development, and supervisors at various levels in the organization. And there is available a choice of informational and developmental training methods.

As previously mentioned, the two major means of giving informational training are the plant school and so-called on-the-job instruction. The plant school permits of certain efficiencies, in that special apparatus need not be duplicated, that outstanding instructor talent can be concentrated, and that attention can be given wholly to the needs of the student. The training material can be presented easily in a sequence based on the difficulty of learning rather than in the sequence in which the job must be performed. As a general example, in actual practice one cannot fly an airplane until it has been taken off the ground, yet intelligent teaching would cover straight and level flying before "take-offs."

On-the-job training saves travel time and time off the job, but is restricted by the limitations of the job then in progress, by the necessity for guarding against harmful effects on the service, and by the fact that the local foreman must serve as instructor. With the latter point in mind, a program of instructor-training for foremen has been carried out.

In practice, both of these methods are used, the choice being dependent upon the economics of the situation; often, in fact, a student alternates between school and job, getting from each that which it is best fitted to give.

The Developmental Method

Perhaps the most important part of the training of a supervisor lies in a carefully conceived series of experience assign-

ments which will give him the proper background for his job.

Given this background, it is still necessary for the supervisor to learn to evaluate his experience properly. Lacking complete experience, the experience of others must be made available to him, usually in the form of typical cases; and again he must learn to evaluate.

Developmental training is fundamentally a means of teaching how to evaluate experience. It pre-supposes an adequate background of actual experience or provides something in the nature of synthetic experience.

The ability to analyze and weigh either his own experience or that of others is acquired by the supervisor through a recognition of the factors involved and by practice in logical reasoning. It is the function of developmental training to give—or rather to improve—the individual supervisor's performance along these lines. The usual technique is that which has been variously known as the conference method, the discussion process, or simply as the developmental approach.

Conferences, in this sense, are discussions conducted in such a way that the supervisors who are members of the group contribute virtually all of the data and ideas, and reach unanimous conclusions which are definitely their own considered beliefs. The function of the leader is to confine the discussion to the subject in hand, and to see that all of the data are brought out in the discussion so that the logical conclusion will be reached. To do this, a rather extraordinary degree of skill is needed by the leader. For this reason, conference leaders have been given rigorous and extended training in the understanding and use of the necessary technique.

In addition to these more formal conferences, many meetings are held between adjacent levels of supervision in connection with the routine conduct of the business. Recently some progress has been made in training higher supervision in the use of the conference technique, so that these men may use this as a teaching vehicle, both in group discussions and in individual

dealings with their immediate subordinates. This might be likened to the on-the-job phase of craft instruction, whereas the formal conferences are similar to plant school teaching.

The Objective

Thus the gamut of training is run: men at various stages of progress, with jobs of differing degrees of difficulty, and with great or small responsibilities. Training at centralized schools or widely distributed as the telephone work itself must be distributed. Training informative only, and training designed to stimulate the inner growth of the individual. But throughout this variegated pattern runs one common thread: the determination so to select training material, so to time training courses, and so to select and apply training methods that the Bell System may serve the nation successfully in these days of complexity and change as it did in the simpler days gone by —by virtue of the "good telephone man."

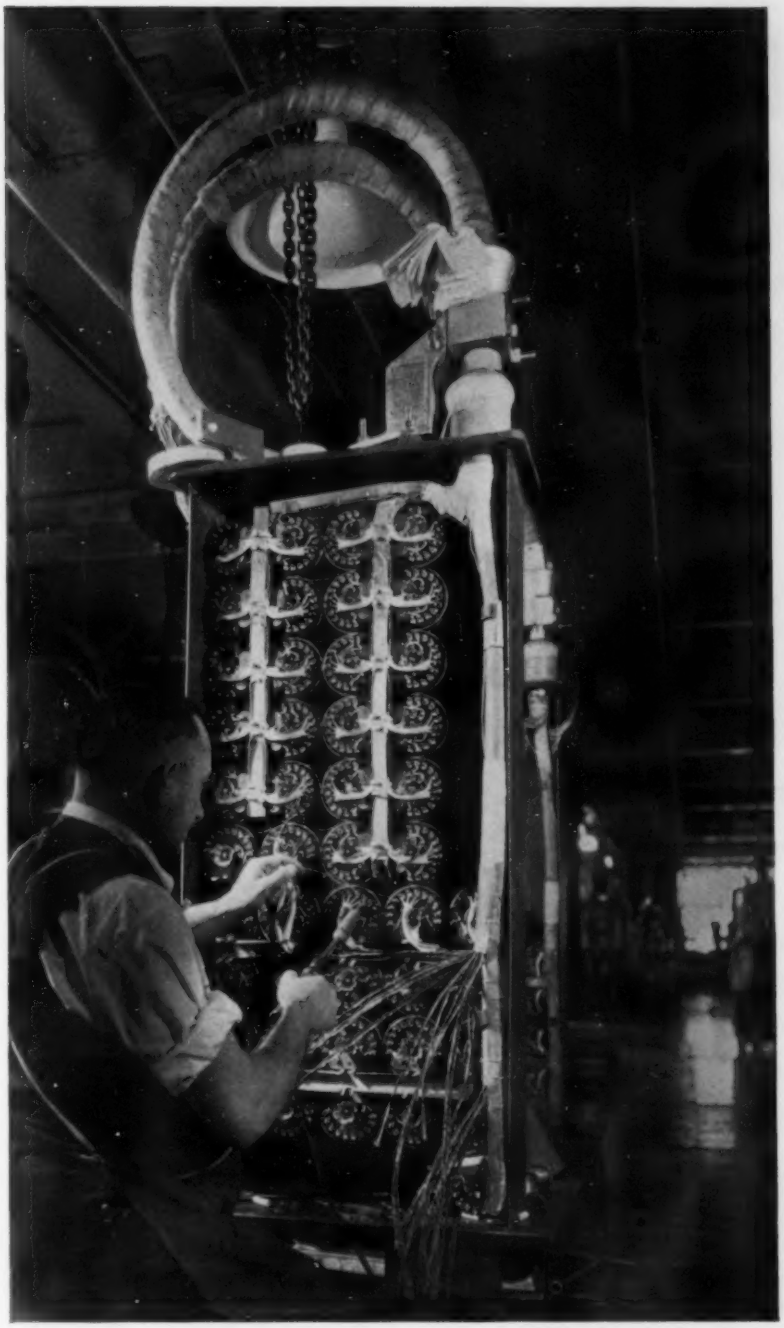
C. T. Schrage

THE ART OF THE MAKER

For the Bell System, the art of making telephone equipment, and of designing and applying the mechanisms of meticulous precision or of giant strength that are required for its standards, resides in the Western Electric Company, an organization of some 40,000 people. In them inheres the accumulated skill of nearly 70 years. Expressed in numbers, that skill is capable of producing, and does produce, 155,000 separate piece parts which, variously combined, enter into 43,000 different designs of finished apparatus.

Viewed in perspectives of large groups of men and women at work and of unusual mechanical functions, the intricacies of the manufacturing art are lost to sight in the magnitude of the joint effort. It is to acquaint readers of the QUARTERLY *with some of the details of the individual craftsmanship reflected in Western Electric apparatus and equipment that the following pages are presented.*

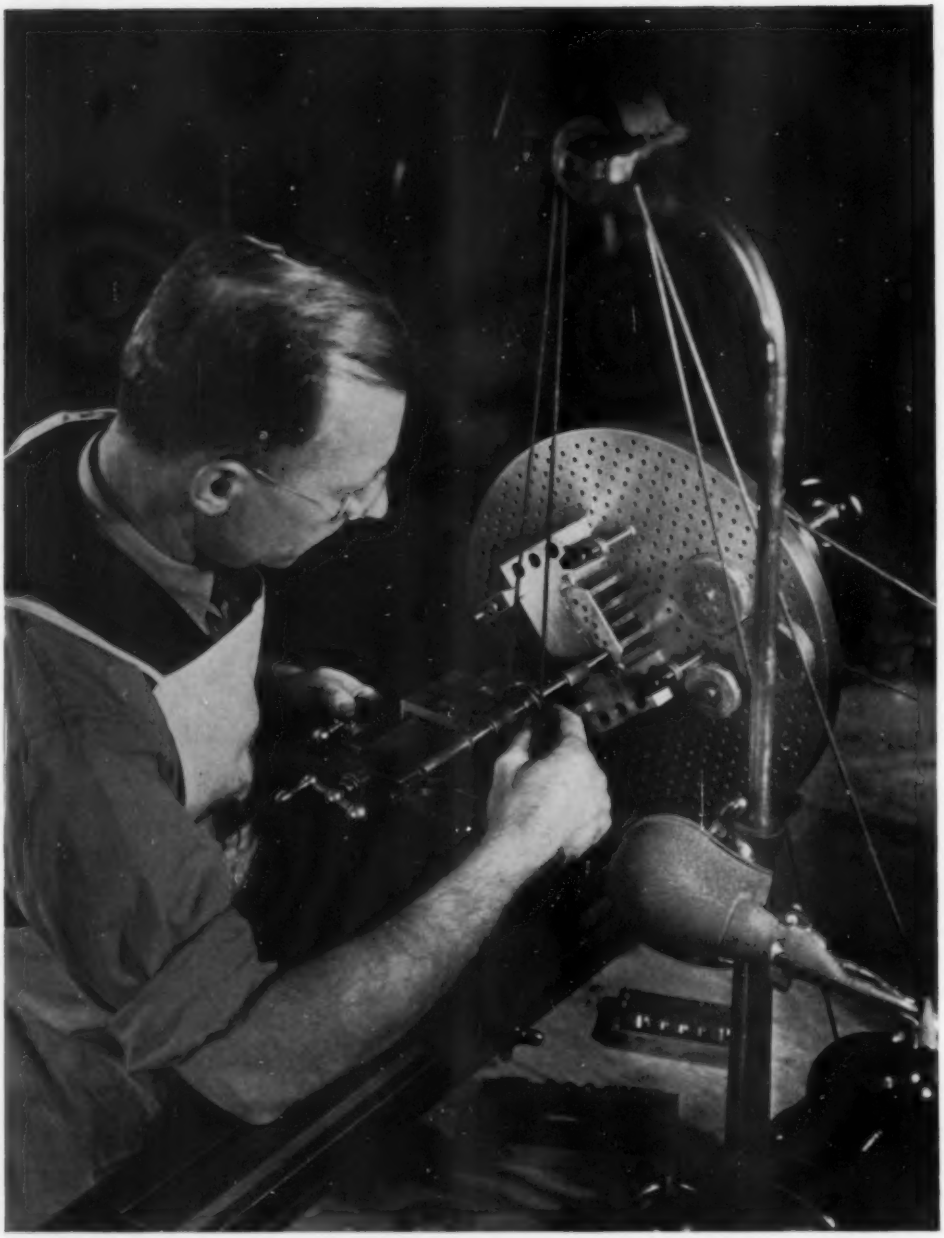
This set tests 204 connections on a cable terminal. Placed upon the elevator in the set, the cable terminal is lowered until it makes the proper contacts within the set. By throwing a switch on the panel, the operator starts a sequence of electrical tests which show up defects in insulation or wiring.



Assembling loading coils in the case. Before the loading coil was invented, the longest satisfactory telephone circuit was about 35 miles. Today, using loading coils to tune out distortion and repeaters to boost the current, your trans-continental telephone call is as perfect as a call to your next door neighbor.

This gleaming, molten billet is lifted red hot from its mould by the electric chain hoist. This is one of the processes in reclaiming used metals and returning them to the telephone plant again, in this particular case as bronze drop wire which will be made from the billet.

Flame from the bunsen burner plays upon the glass envelope of a vacuum tube, preventing too rapid cooling after the glass has been sealed. Under the watchful eye of the expert, the tube is gently nursed to keep it from cracking.



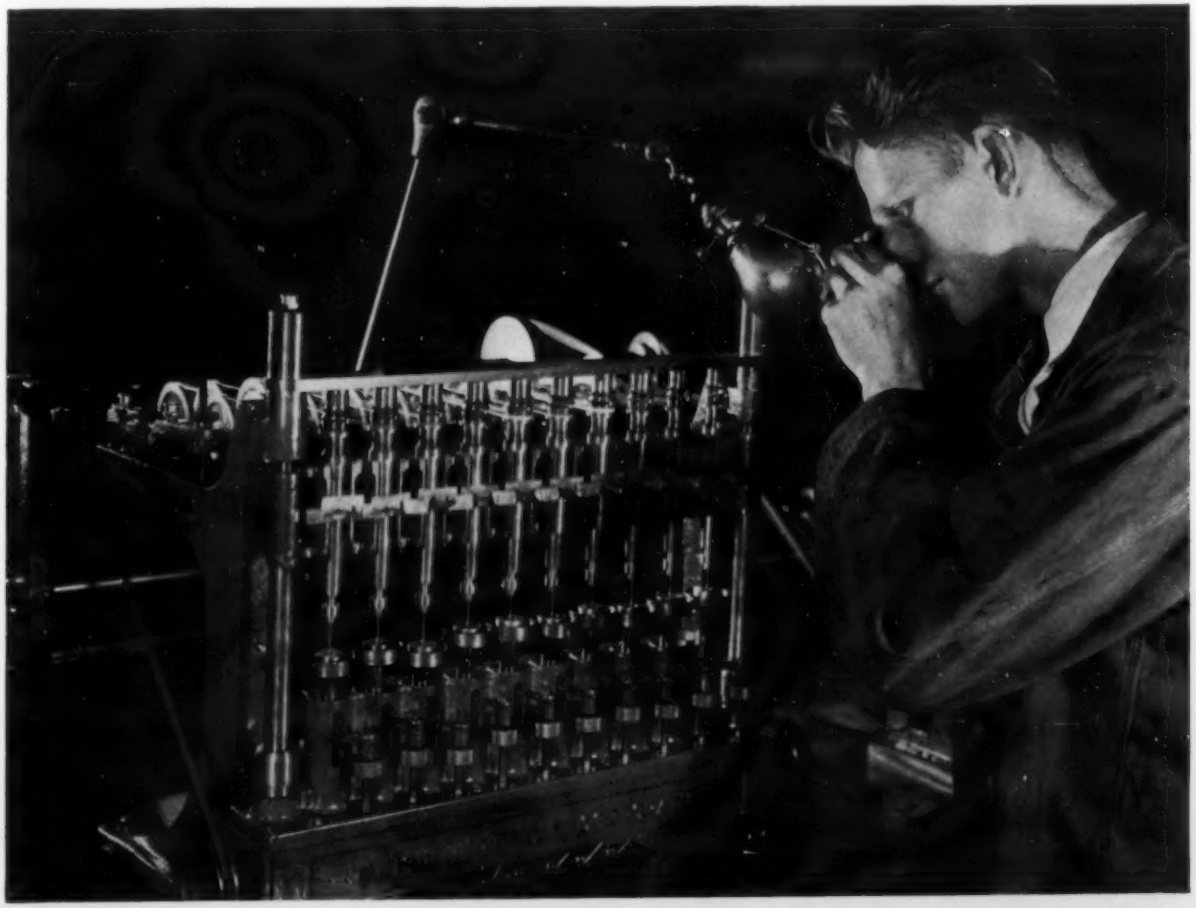
Grinding holes in hardened dies to correct distortion caused by heat treating is a delicate job. After the grinding operation, the holes will be in correct relationship to each other within .0002 inch, or one fifteenth of the diameter of a human hair.

Telephone cords get their finishing touches. The punch press operator is putting terminals and metal supporting bands on the cords.

Under the sure touch of the craftsman, this bewildering maze of wire will shortly be converted into a neat and orderly bay of relay rack in a central office, with every last wire soldered to its correct terminal.

Adjusting clutches on friction roll drives on panel dial exchange equipment. These drives move the selector rods which make the desired connections.

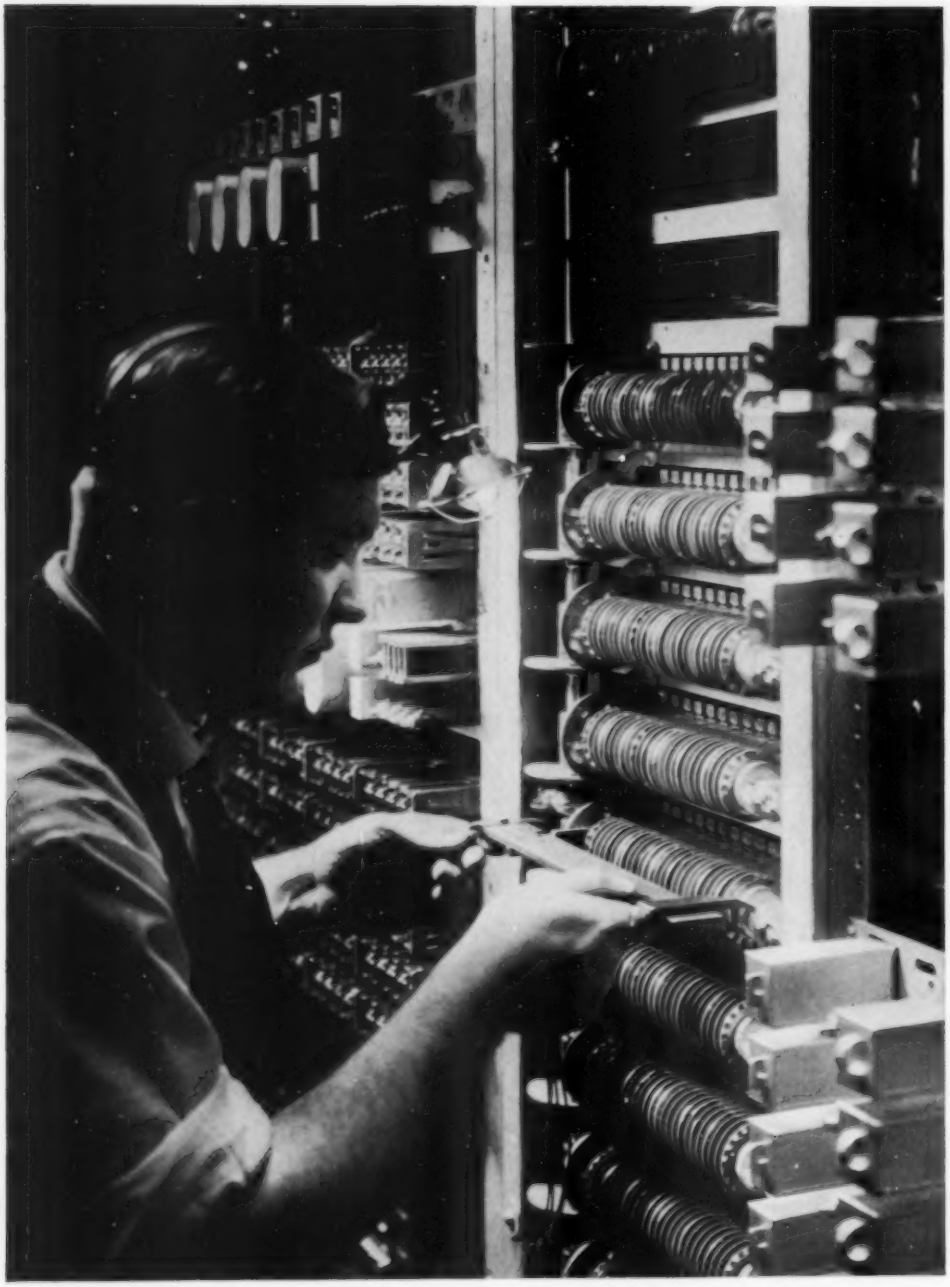
Mounted on a device similar to a lathe, the glass tube and the copper band spin swiftly before the gas flame and finally form a perfectly sealed joint. Thus a water-cooled type of transmitting tube gets its copper collar.



As wire used in telephone circuits must be of uniform diameter, certain sizes are drawn through holes pierced in a series of diamonds until the exact dimension is obtained. The machine shown here drills and shapes the holes in the diamonds. The diamond dies are produced with an exactness of one fortieth of the thickness of a human hair.

After this skilled worker determines the exact axis of the glistening Brazilian quartz crystals on the table before him, diamond-studded saws will slice the crystals into slabs to be ground to the proper size. Used in filters, making it possible to hold a number of telephone conversations over the same wire at the same time, the crystals in many cases must be accurate to within one fifty-thousandth of an inch in thickness and one one-hundred-thousandth of an inch in length.

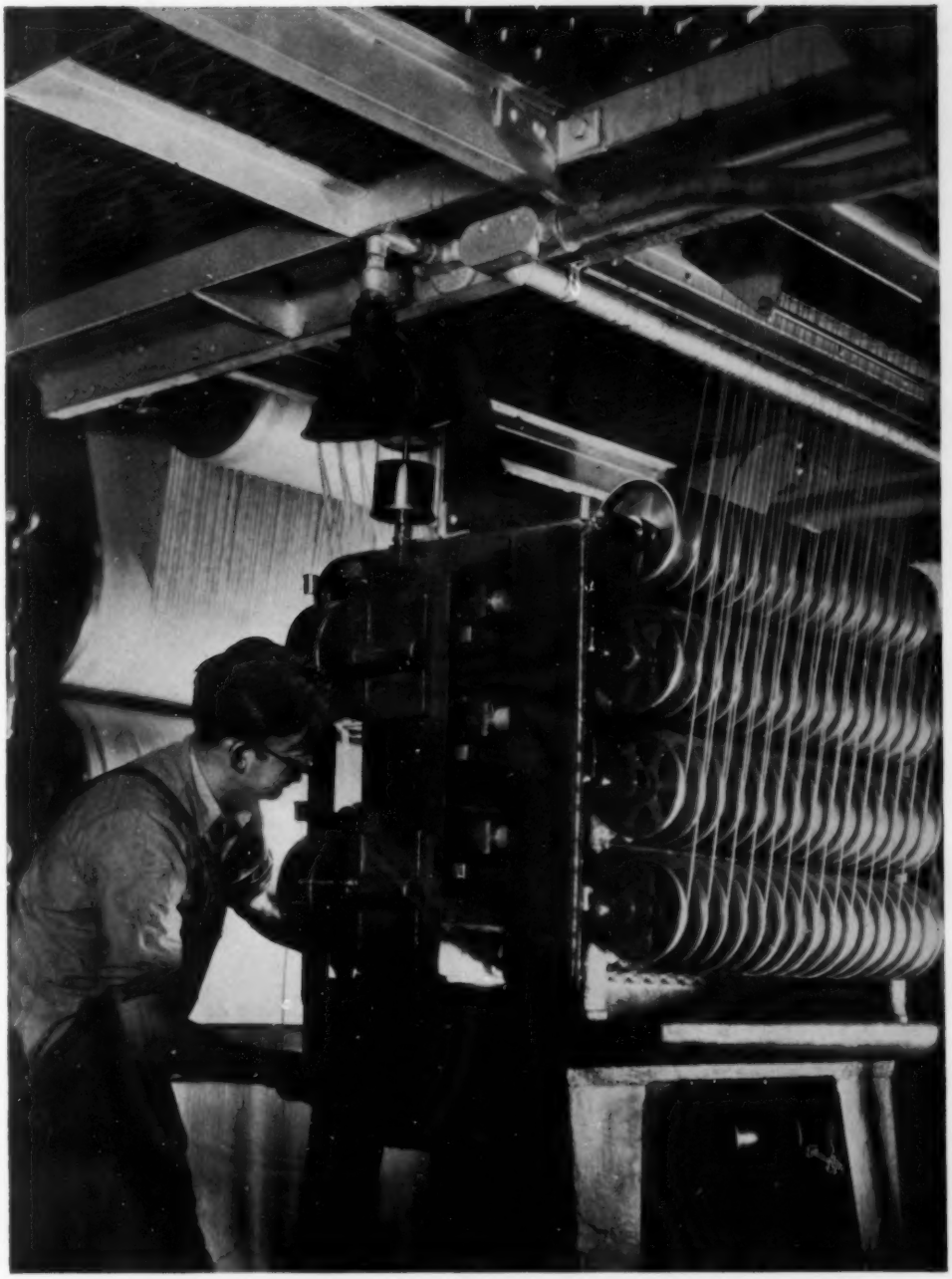
By peering through a Zeiss optical tester at the master plate having accurately located holes, this inspector is able to determine the accuracy of the ratchet wheel shown mounted near the right end of the shaft. The ratchet will be used as part of a device for stamping out solderless cord terminals.



Checking up on the versatile sequence switch. This interesting device, which plays a prominent role in the panel dial exchange equipment, can accommodate as many as 24 cams with four brushes to each cam, so there may be 96 separate wire connections to a switch.

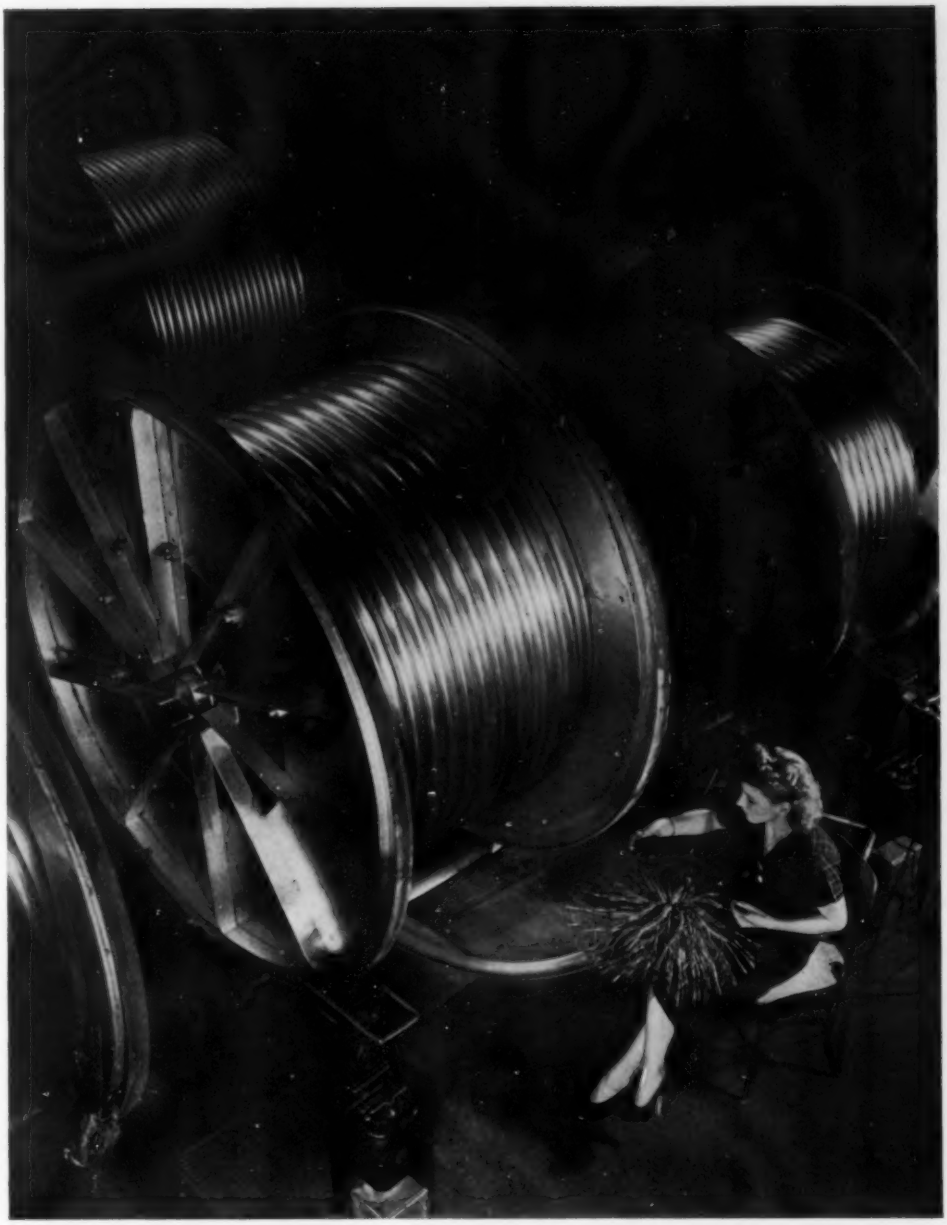
As the facilities with which Western Electric manufactures equipment must be of the highest accuracy, the machines required to build these facilities must be, if anything, even more precise. This jig borer, used in the tool and machine construction departments, works with an accuracy of one ten-thousandth of an inch.

As part of the tool making process, precision gauge blocks of extreme accuracy are used in making this set up for grinding a profile on a die section. The die will be employed to manufacture one of the parts used in telephone apparatus.



This is the polishing unit of a paper-pulp insulating machine, a machine which makes it possible to form a coating of wood pulp right on the copper wire as its insulation. The machine applies pulp on sixty wires at once and replaces the old process of wrapping individual wires with paper ribbon.

Detecting what the human eye cannot observe—the electrical values of telephone cable. This testing equipment determines whether the resistance and capacitance of representative pairs of conductors meet their specified requirements.



Before being sealed and shipped from the factory, this large toll cable is inspected for electrical properties, which are important for proper transmission of telephone messages. The inspector here connects one pair of conductors at a time to leads from the testing apparatus, enabling another inspector located a short distance away to make the necessary measurements.

Notes on Recent Occurrences

BANCROFT GHERARDI RETIRES AS A. T. & T. VICE PRESIDENT AND CHIEF ENGINEER AFTER A DISTINGUISHED CAREER OF 43 YEARS OF BELL SYSTEM SERVICE

NEARLY 600 men and women of the Department of Operation and Engineering of the American Telephone and Telegraph Company gathered on April 21 to do honor to Bancroft Gherardi, Vice President and Chief Engineer, retiring at the end of the month after 43 years of notable service to the telephone industry and a career which brought wide recognition of his achievements both within and outside the Bell System. He was presented with a Washington desk and chair, and with a choicely bound volume which bears a message of tribute and the signatures of all present and many former members of his Department.

Prefacing the book of signatures of all the members of his Department, which was presented to Mr. Gherardi on their behalf by Miss Louise Barbour, of the Traffic Division, is this inscription:

> "Bancroft Gherardi:
>
> "On the occasion of your retirement as Vice President and Chief Engineer of the American Telephone and Telegraph Company, the members of the Department of Operation and Engineering have gathered to express regard and esteem for your inspiring leadership and your distinguished career.
>
> "You have been a vital force in the remarkable development and growth of the communications indus-

try during 43 years of Bell System service and we honor you for your outstanding achievements.

"We individually wish you health and happiness in the years to come."

In presenting the desk and chair to Mr. Gherardi, B. S. Stevens, Engineer in the Plant Engineering Division, took occasion to review some of the outstanding features of Mr. Gherardi's distinguished career. He said:

"Under the continuous leadership of Bancroft Gherardi, the Department of Operation and Engineering has become a vital force in the forward progress of the Bell System. In this progress of the largest private business enterprise in the world we, in this department, have felt the inspiration of orderly accomplishment of our individual parts. We know that this has been greatly due to the guidance of a man with unsurpassed background of sheer telephone ability fired by honest zeal and tempered by broad human sympathies which have won him our esteem. It is this feeling of esteem which prompts our congratulations to him on his well earned right to whatever leisure he may choose.

"Whatever his choice, it is safe to predict that anything he may say or do about the art of electrical communication will further its advancement. His record of 43 years of active participation and leadership in this advancement spans the period of development in this country from about 300,000 to more than 19,000,000 telephones. It reaches back to the time when telephone subscribers cranked their hand generators and a 1000-mile connection from New York to Chicago was truly long distance. It has come down to this day when metropolitan dial systems are commonplace and when a telephone conversation around the world via wire and radio has actually taken place.

"Throughout this period of rapid evolution in the communication art, nothing has stood out more than the successful or-

ganization of the technical forces in all the branches of business activity involved. In the direction of this organization work the record of Bancroft Gherardi has been outstanding and can be visualized only in part by a brief recital of some of the events in his career.

"In 1895, with the Degrees of B.S. from the Brooklyn Polytechnic Institute, M.E. from Cornell, and a Post Graduate M.M.E. also from Cornell, at the age of 22 Bancroft Gherardi started his telephone career testing some of the relatively few telephone cables in the area now operated by the New York Telephone Company. Telephone authorities in New York and New Jersey thought well of this young man's work in traffic as well as plant engineering, and in 11 years, five of them spent as Traffic Engineer of the New York Company, he became Assistant Chief Engineer of both Companies.

"About a year later, when Mr. Vail, just after becoming President of the American Telephone and Telegraph Company for the second time, set about developing a strong headquarters staff in New York, he moved promptly to bring about the selection of the right man for the important job of Engineer of Building and Central Office Equipment. The right man was Bancroft Gherardi, who has completely justified the foresight of his selection.

"Three years later it became clear that Plant Engineering in the Bell System should benefit if guided by one man. Bancroft Gherardi was the man, and he served nine years as Engineer of Plant in charge of Plant Development and Standardization for the Bell System. His record on that job, during which he directed such accomplishments as the Boston-Washington underground cable and the first trans-continental telephone line, made him the logical choice for Chief Engineer.

"Two years later, with the development and research activities of the System separately organized, it was recognized that advantages should result from focusing responsibility for those activities of the A. T. and T. general staff relating to the engi-

neering and operating technique of the Bell System. The logical focus for this responsibility was Bancroft Gherardi, and he became Vice President and Chief Engineer in charge of the Department of Operation and Engineering of this Company.

"We know Mr. Gherardi's record as the head of this department. We know of his great personal influence in his relationships with all of the field and staff leaders in the Bell System. We know that he has played a great part in establishing good relations with the power companies whose network of lines parallel the telephone lines so extensively in this country.

"Perhaps some of us are not so familiar with his other related activities which have caused engineers and scientists in other walks to enlist his aid and to do him honor; for instance, we have just referred to his relations with the power companies. In this he led in the formation of the Joint General Committee of the Edison Electric Institute and the Bell System, and is Bell System Chairman of that Committee. He is also Bell System Chairman of the Joint General Committee of the Association of American Railroads and the Bell System, which is concerned with similar problems.

"In the A. I. E. E. Mr. Gherardi has been a manager, Vice President, and was President during 1927 and 1928. He has served on such Committees as the Executive, the Edison Medal, the Finance, the Headquarters, the Public Policy, the Research, and the Constitution Revision. He has represented the Institute upon the Board of Trustees of the United Engineering Trustees, Incorporated, the Library Board, the National Research Council, the United States National Committee of the International Electrotechnical Commission, the John Fritz Medal Board of Award, and other bodies. He served as President of the United Engineering Trustees and as Chairman of the John Fritz Medal Board. During his association with the A. I. E. E. he has been the author of many important contributions included in their transactions.

"Let us just mention some other jobs which have occupied part of his leisure time:

> Trustee of Cornell University
> President of the American Standards Association
> Representative of the Bell System in charge of Relations with the International Advisory Committee on Telephony
> Chairman of the Engineering Section of the National Academy of Sciences.

"Some of his honors should be mentioned also, such as Honorary Degrees of Doctor of Engineering from the Brooklyn Polytechnic Institute and from the Worcester Polytechnic Institute, and the emblem of the Fourth Order of the Rising Sun, which was conferred upon him by the Emperor of Japan. In 1932 the American Institute of Electrical Engineers awarded the Edison Medal for that year to Bancroft Gherardi 'for his contributions to the art of telephone engineering and the development of electrical communication.' Quoting from the Institute's announcement of this award:

> 'His broad vision as to the place of communication not only in the affairs of the people of the United States but also in world affairs, and his initiative and skill in the development of engineering and operating organizations and in the development of the art generally, have contributed enormously to the growth and success of present day communication.'

"Mr. Gherardi, it seems to us that with this record behind you, you may wish as the spirit moves you in the future to express yourself in writing now and then. If this should be so, it would please this group of people to have you accept for such use a desk and chair of a type favored by the first Presi-

dent of this country, who was a great engineer and who exemplified many of the qualities which we have found in your leadership of our work."

WILLIAM H. HARRISON ELECTED VICE PRESIDENT AND CHIEF ENGINEER OF A. T. & T. CO.

WILLIAM H. HARRISON, who was elected on April 20 to succeed Bancroft Gherardi as Vice President and Chief Engineer of the A. T. & T. Co., was born on June 11, 1892, in Brooklyn, N. Y., and after graduating from high school in 1909, he obtained a position with the New York Telephone Company as a repairman. In 1911 he was transferred to the repair shop, where he was engaged in apparatus inspection, assembly, etc. On December 4, 1914, he became associated with the Engineering Department of the Western Electric Company and was assigned to circuit design work. During a portion of this time he was also a student at Pratt Institute, Brooklyn, where he was graduated in 1915 in Industrial Electrical Engineering.

In 1918 Mr. Harrison became associated with the American Telephone and Telegraph Company in the Engineering Department. This department was divided in 1919 into two groups, one concerned with problems of operation and engineering and the other concerned with problems of development and research. Mr. Harrison became identified with the first group, and in 1924 was appointed Equipment and Building Engineer. Four years later, on December 24, 1928, he became Acting Plant Engineer, and on October 1, 1929, he was appointed Plant Engineer. In 1933 he was elected Vice President in charge of Operations of The Bell Telephone Company of Pennsylvania and The Diamond State Telephone Company, assuming his new post on April 1 of that year. A few months later he was elected a Director of The Bell Telephone Company of Pennsylvania and appointed a member of the Executive

Committee of the Board of Directors. A similar election and appointment were made shortly thereafter with The Diamond State Telephone Company. On February 1, 1937, he was appointed Assistant Vice President in the Department of Operation and Engineering of the American Telephone and Telegraph Company, succeeding K. W. Waterson.